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Being a belated introduction by

Warren S. McCulloch\*

to

THE LOGICAL STRUCTURE OF MIND

An inquiry into the philosophical foundation of psychology and psychiatry

by

Eilhard von Domarus

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Dedicated to

Professor F. S. C. Northrop

in gratitude for continuous assistance



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# ΛEKTON

In 1943, Kenneth Craik wrote The Nature of Explanation; Wiener, Rosenbluth, and Bigelow, Behavior, Purpose and Teleology; and Pitts and McCulloch, A Logical Calculus of the Ideas Immanent in Nervous Activity. These heralded the new era in physiological psychology, in cybernetics, and in the theory of automata. Each presents the unity of nature unparceled into mind versus matter, or pure mathematics versus pure physics. But the old schism is reappearing, and in my field the theory of automata is becoming a purely mathematical automata theory, separate from the biophysics of brains and the engineering of computing machines, and both factions indulge in those reductionisms that Donald MacKay has christened "Nothing Buttery." Man, viewed as a finite automaton, is neither just the homomorphic projection from a free monoid onto a finite monoid or subgroup with an identity; nor is he a mere machine, just matter in motion. He is at least both, and requires for his description a relation systematically excluded in each reduction. Unfortunately that relation is triadic, and for such relations we lack, even for extensional logic, an effective calculus. For years I have said this, and every time I have been asked why I thought it was of any importance. Tarski has always agreed with me, and last summer, in Jerusalem, he put it even more sharply by saying that we have no effective calculus for any intentional relations. My friends, whether they understand me or no, insist that I must devote one lecture to making clear why such a calculus is necessary and what constitutes intentionality. This is that lecture.

In Jerusalem I had answered Shakespeare's question, "What's in the brain that ink may character?" with the word "Lekton." Stoics were pansomaticists and would allow no disembodied notions. For them, a proposition consisted in three related physicals. The first was the utterance, the sentence spoken; the second was the physical to which it referred, say, the rising of the sun; and the third was something in the head like a fist in the hand, the Lekton, or the 'that which can be said.' Theirs was a logic of propositions which may be intended, and it is this

that separates it essentially from its prolific adversary, Aristotle's logic of classes merely existing, by which it was eclipsed for two millennia. It was not until the last third of the previous century that Charles Sanders Peirce tackled the problem, out-Kanting Kant and out-Hegeling Hegel in attacking Aristotelian logic. Peirce noted correctly that there is what he called "firstness." This resembles the goal of physics, and is concerned merely with what is, the mere event. There is "secondness," concerned with the relation of a proposition to the event proposed, and hence capable of two values, either true or false. Finally, there is "thirdness," relating the two and itself, hence triadic. By the time I was born, the logic of propositions had been rediscovered and was rapidly expanding to give us multiple-valued logic, modal logic, and modular logic; and, more recently, at Von Neumann's insistence, probabilistic logic, in which the logical function, not merely its argument, is infected with uncertainty. But, unfortunately, the pansomatism of the Stoics was lost in the mathematics of the logic. So Naive Realism and Platonic Idealism, as biology and mathematics, went their separate ways, ignoring the *Lekton* and intentionality. Thirdness was represented then only in German Act Psychology, which made intention the defining characteristic of psychic activity. In this country it was run out by Gestalt, empty organism, pseudo-pragmatism, and behaviorism, and no logician had a look at it.

So began the roaring '20's, when I came from years of philosophy to take my M. A. in psychology. I had attempted to clear up these questions by inventing a logic for verbs other than the copulative but to no avail. Thanks to Morgan, of fruit fly fame, I had a genetic model of information flow through ranks of neurons. I had turned to neuroanatomy, ground my way through medical school, and was serving as intern and resident at Bellevue Hospital with Sam Wortis, who accused me of always trying to write an equation for the brain. That is what I am still trying to do for the reticular core of the nervous system.

Then the world changed suddenly. Akermann arithmetized logic, one of my friends at the Bell Telephone Laboratories produced a measure of information, and, to top it all, Larry Kubie invented reverberating nervous activity. My theory of nervous nets computing through ranks of

neurons could not cope with this, and it had to wait another dozen years for Pitt's help. The "Depression" hit, and in 1932, I went to the Admission Service of Rockland State Hospital, where I ran into Eilhard von Domarus, the only other trained philosopher I have ever known who was forced into neuropsychiatry by philosophic problems. We struck a bargain, he to teach me psychiatry and I to help him put the ideas of his thesis into English. For over a year we battled nightly. Let me assure you that the ideas, with the exceptions he notes, were his own. I know it, for I disagreed with him concerning Aristotle, Aquinas, Bruno, physics, logic, and probability. Nevertheless, I did reduce to English, at least partially, his monstrous sentences without losing his ideas. With his permission I used this text in teaching for 11 years as a professor of psychiatry, with all my students in the field who were not incompetent, frightened or perverse. I have his permission to publish it whenever I think it useful to his fellow scientists. This is the proper occasion, for I know of no other text that so clearly sets forth the notions needed for an understanding of psychology, psychiatry and finite automata.

Eilhard von Domarus is dead. He hated solemnity, and in his most serious moments made every point with a ponderous joke. His Excellency, Wilbur Cross, Governor of Connecticut, said that any formal dinner was tolerable if he could have Domarus for a seatmate, "... for he always furnishes you with an argument and Heaven help you if you do not understand him when you laugh."

# THE LOGICAL STRUCTURE OF MIND

## PREFACE

No book can be understood or evaluated apart from its origin and function in the development of human life. It exists as a small sample of the language in which it is written. Its meaning depends upon the traditional and current symbolic association of its words with particular things. This preface is designed to relate this inquiry to the world of thoughts and things.

Aristotle and Hegel habitually prefaced theoretical discussions by statements intended to relate the argument through language to the experience of the reader. This they did because they were concrete thinkers. They thought first of experience. Analysis of that experience created abstractions, which they never mistook for the concrete. This is important in this thesis, which is basically Aristotelian in relation to fact and Hegelian in development presumably because biology was my first concern in school, and dialectics, my avocation during the war,

Every philosopher knows that it is sheer presumption for any man to call his ideas his own. Had it not been for Kuhlenbeck, with whom I worked on the anatomy of the brain, I might never have become interested in how the nervous system arose or what function it served. Having worked with him I could neither forget it nor be content with it alone. To him psychology and psychiatry were studies of its most complicated manifestations in health and disease. This brought me to Kraepelin and classic psychiatry, which I studied with Berger, Birnbaum, Bumke, Bostroom, Kahn, Hoche and Westphal. Those seven years in Germany, during which hospital work kept me in constant contact with the insane, convinced me of the applicability but inadequacy of that psychiatry. There was in theory one gross hiatus, bridged only in practice with the patient. The attempt to understand that bridge gave rise to the present inquiry.

The way in which the question arose suggested that the solution was to be sought in the nature of experience itself. I was at the time in Freiburg and turned to Husserl for phenomenology. My personal indebtedness to him is greater than appears in this thesis. He was concerned with mentality and clarified for me the notion of transcendentality in terms of intention. On account of his teaching my study in psychology began, though it did not end,

with the writings of Brentano. Hence the chapter on the Sciences of Mind.

But the bridge, so defined, was not substantial. What was requisite was a theory of knowing. I came to Northrop for the philosophy of science. His chief interest was in understanding the known in terms of how that known arose and of how knowledge of it was systematized in terms of logical relations. Through him I became acquainted with the work of Whitehead and the development of mathematical physics. Hence the chapter on the Science of Matter. While studying with Northrop the problem of understanding as of ontological importance, particularly in biology, became clear to me. At his suggestion I wrote this thesis as a dissertation presented for the degree of Doctor of Philosophy in Yale University.

The nature of the bridge was now clear, but the notions seemed too general for application in psychiatry. I spent the ensuing year with Heidegger studying hermeneutics, the problem of being and becoming for man, or, of how the way in which we heed the world determines what is there for us. He was lecturing on Aristotle and explained the *metabasis eis allo genos*, which is the shift in kind of being undergone by certain entities, as dependent upon a shift in the way we heed those entities. The exposition of "Minding" shows my indebtedness to him. It was he who emphasized to me the quality of Jasper's contribution. At this stage of its development the thesis served as outline for a course on the Philosophy of Mind.

In 1932 I returned to the study of the insane at this hospital and met McCulloch who has worked with me for more than a year at the present formulation of the thesis. His chief interest has been in the neurophysiological approach to the processes responsible for anticipation, purpose, thought and speech and in the product of these processes; specifically, in the propositions of fact and sentiment. The central problem for him is how organisms may be affected so that new propositions are induced. Through him I became acquainted with Pike and the theories of Hughlings Jackson; with him I elaborated the theory of "Mattering."

Though the dialectical development of this theory was Hegelian, the analysis of experience and its relation to fact is Aristotelian. For the thesis, the facts of importance were, and are, particular experiences with particular patients. My greatest obligation remains to them as the origin and final test of the theory presented in this book.

E. v. D.

Orangeburg, N. Y.  
March 1934.

## INTRODUCTION

Men go mad. In the sixteenth century wordy Polonius attempting to say what constituted madness was brought abruptly to the conclusion that it was to be mad. Psychiatry has attacked this matter with more manner. The problem is fourfold. Sociologically it is to prevent alienation and to reconcile the alienated. Psychologically it is to preserve sanity and to heal the insane. The solution was first attempted by those who described the mad men entrusted to their care. These keepers were jailors and priests rather than physicians and their descriptions are consequently in terms of crime and sin rather than of disease. The writings of Rosanof and Sigmund Freud on hysteria present belated punitive and demonological procedures. The problem of psychiatry remains unaltered. The practice proves it unsolved.

During the last century physicians, trained in science, initiated the dispassionate observation of patients. This was the beginning of the empirical approach which has yielded valuable information. But the findings were prematurely cast into heuristic systems no one of which has survived its decade without destructive qualification. Yet this procedure has disclosed much that will be of use in scientific psychiatry.

At present, on account of the development of sociology and physiology, the study of mental life as psychiatry and psychology is expanding rapidly. But progress requires the assumption of an analytical attitude comparable to that in other fields of science.

In order to formulate the concrete problem psychiatrists must consider the man as a member of society and as a society of members. As long as the psychiatrist is content with empirical procedures cross-classifications will exist. The science of alienation from society and the study of the physiological psychology still progress in the main independently. In terms of each there is the norm, the disease and the cure. Such multiplicity is impossible in a scientific procedure of psychology or psychiatry. For this must be founded on a conception of causation limited in no final sense by the man either as the ultimate unit of the social system or as the ultimate system of physiological units. What is required is a science of mind and matter transcending the man. These must be studied in their normal and abnormal

manifestations. Only on such knowledge can a rational therapy be founded.

This science must be experimental; that is, methodologically, it must be reasoning from facts to hypotheses submitting to the test of experience. The rational process is the same, no matter what is considered. Each science is a limitation to particular phenomena and their complex relations. The reasoning employed is usually correct when the notions are applicable and adequate to the facts, and the facts are the facts. However impeded and bewildering the process in the field of psychiatry, the approach is basically the same as in all other sciences.

Every science arises in a world possessed of metaphysical presuppositions not explicitly assumed but subsumed in the relations of its requisite symbols which constitute the systematic context in which each symbol is significant. Each metaphysic is largely determined by the notions previously used to explain the known world. With increase of knowledge the old symbols become inadequate for prevalent distinctions, and the systematic context eventually insures the inapplicability of the notions themselves.

Each science is concerned with experience by restriction to some aspect of fact. Facts are inherently concrete in experience, so restriction to specific aspects produces a limitation in the discourse which does not correspond to a limitation in the universe. The history of the physical sciences and psychology shows a slow drift toward the problem of the full concreteness of experience. This is exemplified in the following chapters in which we will consider the effect of earlier metaphysics on subsequent sciences in order to do justice to the work that has been done and, at the same time, to show the concepts of mind and matter, explicit in modern physics and implicit in modern psychology. It is only by a comparative study of metaphysics and sciences that we can hope to show how these relations, implicit in these conceptions of mind and matter, transcend the "individual." Without these we would be limited to some metaphysic comparable to Comtian Positivism which proved a stumbling block to biology and a stone-wall to psychology. The difficulty was not with the facts.

For all of us facts are given. We analyze them into entities called relata which must be synthesized in manners determined by the analysis if that synthesis is to reproduce the original. The manners are called relations. By one mode of analysis things appear as relata requiring mental and material relations to reproduce experience. By an alternative mode

of analysis mind and matter appear as abstract relata concrete in the things of experience. Mind subsumes the mental relations called idea and intention; matter subsumes the material relations called passage and extension. We are concerned with the sort of entities which arise when both modes of analysis are applied to the same facts.

[Our primary concern is with psychology and psychiatry.

We intend to demonstrate the ontological significance of such entities only in so far as they are responsible for the logical structure of mind.

The difficulties which we encounter are inherent in the complexity of the problem, for these are the most obvious examples of experience--the concrete! The psychologist and his subject, the psychiatrist and his patient, all experience; and no system of notions, however symbolized, can appear adequate if it fails to exhibit the concreteness of experience of each in terms of the other. Certain simplicities arise for the physicist because he experiences the world as matter and can neglect all mind save his own. Corresponding simplicities arise for the mathematician because his discourse is limited to idea and intention and he can neglect all matter save his own. Yet the history of both physics and mathematics shows that the only escape from an antiquated metaphysic is into the metaphysic subsumed by the systematic context of the symbols requisite to convey experience in its achieved distinction..

In the so-called mental sciences the necessity of this process becomes obtrusive. Chapter One is the description of it as obvious in psychology; Chapter Two, of its subtle appearance culminating in explicit formulation in physics. [These chapters are intended to provide the systematic context for the symbols Mind and Matter. The notions intended are conjugate abstrata analyzing all entities concrete in experience. They are such that, on account of the givenness of fact, neither can be supposed without the other. Chapter Three relates these notions so as to formulate, symbolically, Minding and Mattering as exhibited in the development of propositionalizing issuing in the logical structure of mind.

This is only an introduction. It is not intended to discourage the reader, but to state what we hope to explain.

## CHAPTER I

### THE SCIENCES OF MIND

ARGUMENT. When men begin to think, they think about things. They do not separate the things from the doings, havings, seemings or meanings of the things. The tree is one with its growing, budding, branching; one with its roots, trunks, limbs, branches, leaves; one with the kind of tree that it is, as an oak or a pine or an olive; one with its significance as shelter, shade and harvest. It is only when thinking evolves enough to relate separate things that these four aspects appear to the thinker as entities which he may consider by themselves. The difficulty which confounded the thinker was this: That of which he wanted to think was not a thing, hence he could not imagine it. Few men have ever been able to attend to these relations without mistaking them for things.

The grammar of all languages bears out this assertion. Doings are originally represented by verbs, havings by prepositions, seemings by adjectives, and meanings by conjunctions; but that of which one speaks is represented by a noun. That is the name of the thing. As language evolves it becomes possible to indicate anyone of these four by a noun derived from some other part of speech, but all such words have a transcendental quality too abstract for the practical man. We are concerned with a theoretical problem and must, for the sake of clarity, define four terms thus: (1) "Passage" will stand for that which is common to the meaning of all ordinary transitive verbs. Severally, it is the becoming of the universe. (2) "Extension" will stand for the relation of whole and part, whether explicit or conveyed by prepositions or the tense of verb. Passage and extension together constitute the material relations of things. (3) "Idea" will stand for that which is common to the meaning of all ordinary adjectives. Generally it is the likeness of things and, therefore, identity within experience. (4) "Intention" will stand for the relation of the symbol to that of which it is the symbol, whether explicit or conveyed by conjunctions or changes in the mood of the verb. Idea and intention together constitute the mental relations of things. All four relations can usually be exhibited in any one complete human proposition.

I WROTE THIS PARTICULAR SENTENCE THAT YOU SEE A COMPLETE PROPOSITION ON THE PAGE BEFORE YOU.

(1) The verbs, WROTE and SEE, exemplify passage. They exhibit the universe as altered. The first created the marks on the paper as material consequences of my neural processes. The second creates your neural processes as material consequences of the marks on the paper.

(2) Extension is exemplified in the prepositions, ON and BEFORE, and in the change of tense of the verb from WROTE (past) to SEE (present). In both cases they show, in the relation of where and when, that the particular occurrences can be regarded as parts of a more inclusive occurrence; but the change in tense is related to the temporal parts in the whole event, whereas the prepositions are related to the spatial parts of that same event.

(3) Idea is exhibited in the adjective, THIS, PARTICULAR and COMPLETE. Each exhibits the universe as qualified in experience. This indicates identity itself in the demonstrative form; PARTICULAR, as a specific one of many; and COMPLETE, as exemplifying all four entities.

(4) Intention is exhibited in the conjunction, THAT, and in the change of the mood of the verb from WROTE (indicative) to SEE (subjunctive). Both exhibit the present occurrence as proposed in the original occurrence. Here there appears a separation in time and space, so that the subordinate clause expresses the purpose of the activity of the principal clause; namely, that you see it. My neural process anticipated your neural process which existed for it only in intention.

This argument is basically Aristotelian, though the concepts have undergone centuries of clarification, and the proposition is not of the type that he attempted to analyze. He was concerned with the relation of things and in our proposition the things are represented by nouns and pronouns: I, SENTENCE, EXAMPLE, YOU. These words stand for things related by passage, extension, idea and intention; and we know that by an alternative mode of analysis the things themselves possess passage, extension, idea and intention; that is, the sentence was written and it endured (passage), in time and space (extension), but it was just that particular sentence (idea) which might equally well have appeared in other ink on other paper and even in another language, and what was meant by that sentence was the sentence itself as an example of the complete proposition (intention). Psychology sprang from Aristotle's analysis.

It was he who made possible the distinction between the sciences of mind and of matter.

ASSOCIATIONALISM. When Aristotle spoke of the Association of Ideas, he was concerned with those more primitive "Ideas" which are primarily images of things. When he spoke of them as things he was cognizant of their transcendental aspect, their transcendent relation to other things, whether these other things were themselves images or originals. Hobbes took these relations for granted; but the tradition of English philosophy, through Locke, Berkeley and Hume, robbed the notion of an "Idea" of all transcendentality. The problem that confronted psychology at inception was how "Ideas" so conceived could be associated. Mind for these psychologists was at most a collection of these "Ideas."

Scientists of that day were acquainted with the discipline of physics and attempted to handle the "Ideas" of their day as physical things. Aristotle had given four laws for the association of "Ideas": Similarity, dissimilarity, continuity and contiguity. Associationalism began with the realization that dissimilarity was only a special case of similarity, no two things being seen as dissimilar unless in other respects they were similar. A second simplification arose because continuity and contiguity could be conceived as mere togetherness in experience. This temporospatial togetherness made it possible for the psychologist to investigate the relating of "Ideas" as the physicist had that of the original things; but of similarity and dissimilarity they could make no use until Mill was able to subsume them in the correct but paradoxical statement that those entities are similar for us which did occur together in experience. This hypothesis reduced associationalistic theory to the hypothesis of physical togetherness. It was then possible to investigate learning from the making of the impression to the proof of the trace as retention, recall and recognition.

In the meantime there had appeared the discipline of statistics in biology. It was now possible to count the number of times, and to evaluate the recency of the particular togetherness requisite for a given learning by an individual or by a group of one or of many of these associations of ideas. The results were not entirely orderly. Another factor than recency or frequency was operative. It was called intensity. A mechanical analogy

for the learning process was then conceived. The conceptual model for the brain was a mountain-side; for experience, a shower of rain; and for learning, the erosion of the former by the latter. Unfortunately, intensity could not be quantified, as recency and frequency, in terms of the stimulus alone. Mountain-sides were not of homogeneous material or uniform contours. They exhibited not merely passive variation but active interference determining the rain. This prevented a satisfactory physical theory without physical investigation within the organism, and induced many associationalists to develop pseudophysical systems or to give up psychology for physiology.

**GESTALT.** To understand the greatest of these pseudophysical systems, one must remember that the majority of the thinking world has become permeated by Comtian Positivism. In it there is no room for idea and intention. In terms of it no mental problem can be stated, far less can it be analyzed. Mind enters such a scheme sub rosa; but it is the very limited mind of the scientist of that day restricted to psychological insignificance by the attempt to define the universe in terms of the physical relations of things; that is, in terms of passage and extension.

This period presents the most grandiose development of Materialism. Physicists had had unprecedented success in predicting and controlling all systems for which they could form mathematical propositions without ever becoming aware of the transcendental relation of their propositions to the systems proposed. Physico-chemical investigations of living systems had produced great advances in the analysis of organic **problems**. Vitalism, as an explanation of the organic world, was losing ground to its prolific adversary.

At this time there appeared Wolfgang Köhler who, with a reputation in physics and in the physical approach toward biological problems, occupied the chair of Hegel. He initiated a psychological school which is founded on an oversimplified statistical concept of physico-chemical processes mistaken for biological processes to the physical aspect of which they are, as stated, inapplicable. He regarded the organism, particularly the cerebral cortex, as a physico-chemical system in equilibrium, the new equilibrium differing from the old only in the distribution

of stress and strain in it. Psychology was for him the study of the pattern of stress and strain in such a system.

This psychology has one characteristic advantage over older forms of Associationalism in that it can symbolize the appearance of a new pattern, or idea, in a given perception, this pattern, or idea, having been absent in the presence of the component parts separately. It yields integrals which are not to be got at by the addition of sensations. Thus these ideas, or Gestalten, seen as patterns of stress and strain, correspond, although only in a purely material fashion, to their originals external to the organism.

In as much as his fundamental conceptions were static, for the dynamic equilibrium was considered as having been reached, Gestaltpsychology was limited to the description of concurrent phenomena with little or no possibility of exposing the problems of ontogeny or phylogeny, disease or decay. In it the Hegelian movement found its dialectical antithesis exemplified in the failure to realize the mental significance of such a materialistic abstraction from concrete experience.

**REFLEXOLOGY.** We have now to return from the pseudo-physical systems to physiology. It was in the middle of the last century that physiology, in particular neurophysiology, began with the discovery by Magendi and formulation by Bell of the law that impulses enter the spinal cord by the dorsal roots and emerge by the ventral roots. Knowledge grew rapidly as to specific paths extant and operative within the central nervous system. It was soon apparent that this was the great coordinating mechanism relating muscular and glandular responses to all external, and most internal, stimulation. Comparative study in neural anatomy revealed a fundamental unity of structure within the vertebral phylum modified continuously from lower to higher forms by an increase in the volume and complexity of the dorsal portion, always more and more expanded and elaborated at the cephalic end.

But certain of the early thinkers about the function of the nervous system were dominated by their antipathy to the notion of evolution. In order to defend the thesis of separate creation, they presumed that each structure retained its function, no matter what new structures were added. And each new structure corresponded to a new function added by God.

A fish has no cerebral cortex. In order to explain why a man without a cortex was not a fish, but merely a spoiled man, they invented "inhibition," inhibitorische Fernwirkung, whereby destructions of the cortex became responsible for the failure to find the behavior of the fish in the decorticated man.

It has been possible to demonstrate that each receptor, or sense organ, is connected to all effectors, or muscles and glands, by an ever increasing number and complexity of neural paths. A second great generalization of neural activity was necessary to explain why a man on whose nose a fly lighted does not immediately suffer a grand mal convulsion terminable only by death. This is the law of the summation of stimuli: Impulses from more than one source are usually requisite for a disturbance to proceed from receptors to effectors through the central nervous system. This insures that to every increase in the complexity of structure, whereby disturbances from many sources are redistributed, there corresponds a greater differentiation of activity. The continuity of the nervous system insures integration.

Early attempts to localize function failed, chiefly because the functions investigated did not correspond to gross anatomical entities. More recent attempts have failed chiefly because of failure to take account of the temporal extension of the disturbance progressing through the central nervous system.

Clinicians correlated the loss of specific responses with the destruction of particular portions of the nervous system and supposed the function lost to be that of the tissue lost, instead of realizing that all they knew was that the remaining functions were functions of the remaining structure. We might caricature this by saying that stereoscopic vision was the function of the right eye because a man who lost his right eye lost stereoscopic vision. The notion of inhibition, or neural shock, prevented a clear conception of what they did actually know. Now return to the caricature. Suppose that we had seen patients who had lost stereoscopic vision by loss of the right eye and attributed that function to that eye, and then had a patient who had lost a left eye; we might now explain his loss of stereoscopic vision by supposing that the destruction of his left eye, by inhibitorische Fernwirkung, prevented his right eye from functioning

stereoscopically, And, as if this had not been enough, the gratuitous hypothesis of the vicarious assumption of function obfuscated all issues. We have discovered that the right eye gave stereoscopic vision and the left eye plain vision; but in our patient who had lost his left eye the right eye vicariously assumed the function of plain vision. This completes the caricature.

A few men such as Hughlings Jackson, von Monakow, Head, Pike, and Herrick have made a consistent attempt to think through the function of the nervous system without resort to inhibition, shock, vicarious assumption of function or hypotheses ad hoc. They have succeeded sufficiently to show that the way from philosophy to neurophysiology is difficult, but the way from neurophysiology to philosophy is easy. The reason for this is that the phenomena with which they are concerned include thinking itself.

The clinician's use of the conception of the reflex, as an entity defined by stimulus and response, was determined by the clinical association of the loss of that reflex with the loss of a particular path through the central nervous system. The reflex was said to be the function of that path. Such a conception of the reflex failed to include the contributions from all other parts of the nervous system to the activity in question as well as the contribution to all other parts of the nervous system by the activity in question. Reflexology arose from the acceptance of necessary for sufficient relations of structure to function. Innumerable specific reflexes were defined, and the behavior of the organism stated inadequately as the sum of these reflexes. It was discovered that while certain reflexes were occurring others could not be elicited. Inhibition was called upon, as the deus ex machina, to explain the findings. Instead of discovering what was actually occurring in the central nervous system, reflexologists were content to suppose that one process forbade the other; and this, though the receptors and effectors, the afferents and efferents, and the necessary shortest anatomical paths through the nervous system had no parts in common. Inhibition in this sense is an inhibitorische Fernwirkung which travels about in the central nervous system where physiological experimentation discloses stimulation.

J. B. Watson and Pavlov laid the foundation of a psychology from which not only thinking but mind itself is excluded.

In the Watsonian scheme this is achieved by the substitution of

innumerable reflexes, parallel or chained in temporal order, augmenting or inhibiting one another but devoid of sub- and superordination. Nothing happens within the central nervous system except the connection of afferents to efferents, a change in the connection being produced only by new stimulation from without the central nervous system. Such an alteration of reflexes so conceived would be a vicarious assumption of function.

Pavlov has achieved the same end by other means. He has explained his invaluable experiments on learning by inhibitions and the inhibitions of inhibitions to the third and fourth generation.

From the day of Hughlings Jackson to the recent work of Head clinicians have never been as far from the truth as that. They have always known that propositionalizing occurred in the nervous system. Injuries to the cerebral cortex were frequently localized by the quality of the defect of that function. They knew also that pathological changes in the diencephalon were associated with marked aberrations in the desires of their patients for food, sleep, sex, exercise, etc.

Propositionalizing and affective and emotional relations found no adequate explanation in the new psychology to which two new concepts were added, namely insight and emotional congruity. These were the last hypotheses ad hoc of Associationalism and seem strange in their new context. Each is a recognition of transcendent relations of the organism investigated. The first, that the organism minds; and the second, that things matter to it.

**SOCIAL PSYCHOLOGY.** Reflexology in the form of Watsonian behaviorism and Pavlov's conditioned reflexes served psychology in two ways: Firstly, in making clear to the psychologist that it is necessary for him to study the phenomena and state observations accurately with respect to passage and extension. Secondly, they have shown such a procedure to be inadequate, differing only privatively from physiology. Thus, though behaviorism, or reflexology, might describe the material relations within and without the organism, it can not describe the mental relations. This having been clarified, men with an appreciation of the concreteness of experience, born or trained philosophers, could not be conciliated by the addition of the concepts of intuition and emotional congruity to

reflexology.

But to understand the new departure we must return to the beginnings of sociology in Hobbes' Leviathan. The unit of sociological investigation was the man among men. His mind was not an aggregation of things, called "Ideas," which failed to transcend him; nor a complicated pattern of stress and strain corresponding in a purely material fashion to what had happened beyond him; nor the sum or difference of reflexes, parallel or chained. This man minded the world, and the world mattered to him. That is, he was in the world and of it. It changed him; and he, it. He knew his world of men; and they, him. Like most of the men of his generation, the world of which Hobbes thought and spoke was the world of men who thought and spoke. They formed propositions and acted accordingly, thus generating society. Sociology, like medicine, never altogether lost track of mind or of matter. But it was not concerned with the correlative nature of those abstractions. It had no orgy of Mentalism or of Materialism, and it was too far from a science to be snared by Comtian Positivism.

There are two languages: That of the mechanic, concerned with the passage and extension, accurate to the thousandth of an inch; and that of the politician, concerned with idea and intention, significant in the fate of nations. Both are of importance in the organization of men into guilds and states. The sociologist could not ignore either language, but he could ignore their relation.

Social psychology, in common with sociology, has this advantage over antecedent psychologies, that it includes idea and intention as such. These are explicit in McDougall's conception of cognition and conation, just as passage and extension are there in his statement of disturbances proceeding from receptors to effectors through the nervous system. Moreover, his conception of the life of the organism as the maturation and conditioning of instincts, as the fulfillment of possibilities genetically determined, bespeaks his equable estimate of ontogenetic factors, neither entelechy nor the effect of the environment being over or underrated.

Two difficulties with his social psychology have become apparent. Instinct, which he supposed to be defined by the restriction of receptors, the path of the disturbance, the characteristic cognition and conation and the restricted effectors, have been shown to merge imperceptibly into one another so that, while the whole may be instinct, it is hardly proper to speak of an instinct. This criticism is obviously less significant here,

where it applies to description, than in reflexology, where it applies to the principle itself.

The fundamental difficulty with his psychology is to be sought elsewhere. He fails to account for thinking. A man defined as a complex of maturing and modified instincts is capable of minding the world and having it matter to him; he is capable of learning, but he is not capable of reasoning. This is so because his cognitions and conations are related by passage and extension to other things, or to other cognitions and conations; but not by idea and intention. As in the theories of the Occasionalists and Parallelists, these have been defined into insignificant illusory by-products of the purely material process. His man cannot reason because he cannot substitute one thing for another the idea of which is the same, and because he does not enjoy the privilege of intending to do so. The world may do it to him; that is, the world may condition his behavior, and that his behavior is altered is all that any other man may know about him as passage and extension; in other words, in so far as he is matter, and someone else minds him. He can mind the world and have it matter to him; only he cannot think. For him there are no propositions.

**DYNAMISM.** Dynamic psychology arose as an off-shoot of social psychology. Its central concept was that of a drive, or trend, an organic activity which due to repetition had come to resemble the instinct as described by McDougall. This off-shoot is of importance to us only because of its relation to the popular explanation of actions in terms of motives. Drives, conations and motives were confounded, thus preparing the way for psycho-analysis.

The theme of desire as of vital importance to the understanding of the universe—above all, of man—through Fichte, Schelling, Schopenhauer and Nietzsche, had dominated German philosophy. It had been carefully elaborated and clearly formulated to explain the actual relations of ideas in so far as these were not inevitably determined by passage and extension from without. The Wunsch was a relation of ideas by virtue of which the occurrence of one intended the occurrence of the other. It is not to be confused with affect, feeling or emotion, with drive, conation or motive. It is not an idea, but the occurrence of an intention made specific only in so far as the related ideas are specified. But, because it is concerned with

the occurrence of those ideas, the passage determining serial order has also to be considered. In this it differs from an intention, that it implies occurrence.

In psycho-analytical publications the term Wunsch has lost its technical distinction. It is impossible to be certain what is intended by any symbol in these writings because the context in which the symbol appears is not systematic, and hence its metaphysical foundation is absent. The term Wunsch appears now for motive, now for drive, now for conation, now for intention, now for desire, wish or will. It is popular to explain a sane man's action in terms of some motive. But we know of ourselves that we are not always aware of our motives, though we may at some other time know what they were. But there are some of our acts, such as walking into a door in the dark or burning our mouths with soup, for which we can imagine no motive. The psycho-analytic explanation of all of these is in terms of the Wunsch. In the first case the Wunsch was "in consciousness"; in the second, it was "on the threshold"; in the third, it was in the "subconscious." Human nature is stratified into the Superego, the Ego and the Id which are approximate demonological equivalents for conscience, the I itself and the lust of the flesh. In addition to these elements derived from religion there exists a law for the ego, a censorship, which operates as a jailor to keep undesirables in the subconscious. But the recalcitrant Wunsch, illogically retaining identity in the subconscious where it assumes new defining ideas as a disguise, escapes censorship, reappearing in consciousness as if it were acceptable to the Ego of which it would form a part. When we sleep the censorship is relaxed and unruly Wünsche from the chaos of the Id masquerade in dream. These are those Wünsche which if they appeared naked would arouse censorship. But the Ego, by compelling them to wear the proper guise, can satisfy them symbolically sublimating them to the Superego. Freud, Jung, Adler, Ferenczi and their patients disagree as to which Wünsche are significant, objectionable or acceptable; or what, their favorite disguises. It is impossible to tell whether these discrepancies are of fact or form, for all make use of middle terms sometimes undistributed, sometimes changing meaning from the major to the minor premise—in this respect resembling the Wunsch which changes its definition without losing its identity. In this psychology no new

concepts appear, but familiar scientific notions are confused and subordinated to punitive and demonological recrudescences.

ACT PSYCHOLOGY. With the possible exception of McDougall no psychologist from Hobbes to Brentano has shown proper respect for the eidetic and intentional relation of thoughts to thoughts, or of thoughts to things. These relations were forgotten while scientific psychology investigated the material relations of passage and extension. But Brentano, Jesuitically trained in ontology and versed in Scholastic Philosophy, approached the psychological phenomena from the mental aspect. His logical training seems to have made it clear to him that the idea itself was just an identity predicable equally of thought or thing, image or original. He, therefore, turned his attention to the problem of intention which he stated to be characteristic of certain psychic acts. He was not concerned with the passage and extension of these acts, but devoted his attention to mind rather than to minding. Yet, because he was concerned with intention rather than with idea, he achieved the statement of that relation that is fundamental to logic and mathematics, which Associationistic psychology had not only failed to formulate but failed to recognize. His followers generalized his thesis concerning psychic acts and made intention the defining characteristic of all psychic acts, thereby excluding many activities ordinarily considered psychic.

The attention to mind, instead of minding, and the restriction to psychic acts characterized by intention, precluded any great experimental fulfillment and rendered the phenomenology of his disciple, Husserl, an elaborate system of theoretical relations among ideas and things, wherein the eidetic relations themselves seem subordinate to the system of intentions, as they are in mathematics, instead of coordinate, as they are in aesthetics. Examination of the text discloses few factual propositions and a tendency to bracket the idea itself. Such imaginative generalizations produce hypotheses whose theoretical justification requires their statement in terms of operations before they can be put to the factual test of experience. Act psychology and phenomenology, on account of their failure to consider the passage and extension and the idea of the phenomenon, have lost contact with the matter and quality of this world. But they have served psychology by clarifying the notion of intention and have shown that no psychology can hope to

explain propositionalizing, thinking, reasoning or any other complex psychological doing, without the relation of intention.

OBITER DICTUM. Thought is always related to thought mentally, i. e., by idea and intention; molecules are always related to molecules materially, i. e., by passage and extension; but these relations are only discoverable or thinkable in the relation of mind and matter, i. e., in the concrete experience. All psychologies have failed that have attempted to ignore the mental or the material relations of thought to thought or thought to thing. In this chapter we have exhibited each psychological analysis in principle as exhibiting, with respect to human experience, a deficiency determined by the inadequacy of its metaphysical foundation. The Associationalistic, Gestalt and Behavioristic schools fail to exhibit mental relations; Act psychology, material relations. Social psychology exhibits mental and material relations of thoughts to things; but not, of thoughts to thoughts. None has achieved an adequate explanation of experience without the introduction of hypotheses made nebulous by the exclusion of methodologically necessary terms simply because these terms were not so preformed for any psychology in the symbolic expression of its conceptions that they could be recognized as such. Actually, the difficulty in psychology arises because the organism, itself experienced, itself experiences not only things beyond it but its own thought. For adequate explanation of experience not only the material relation of thoughts to things and the mental relation of thoughts to things, but also the mental and material relations of thoughts themselves are all immediately requisite; whereas in physics it has been possible, to proceed introducing the required relations explicitly seriatim.

## CHAPTER II

### THE SCIENCE OF MATTER

ARGUMENT. Before there were men, organisms lived or died because they moved more or less; and, when man evolved, he inherited a host of those adaptive movements which had served his ancestors. Implicit in them was the recognition of passage and extension as inevitable relations of things; but these remained implicit and it was not with these, as principles, that physical science arose.

Aristotle had laid down four entities as the relations of things. They have been translated as "efficient cause", "material cause", "formal cause" and "final cause". They differ from passage, extension, idea and intention chiefly in this, that they are always considered by him as particular. The "efficient cause" is the particular activity which produces the given thing, its making. The "material cause" is the particular "material" of which it is made. We now think of the activity as continuous when we speak of passage and of a temporo-spatial distribution of that activity when we speak of extension. To Aristotle the "efficient cause" of that sword was the forging of that sword, and its "material cause", the bronze of which it was made. We know that, for that "material" to be bronze to us, there must be some activity then and there, in the world; and that activity implies passage. Extension can be seen as obviously related to the Aristotelian "material cause" in as much as "matter" is defined as that which occupies space through time. Taken together passage and extension cover the same relations as "efficient" and "material" causes but in a more general and more precise manner. It is obvious that a comparable relation exists between "formal" and "final causes" and idea and intention. But we are now concerned with physics, the proper field of which is "matter", the inevitable material relations of things called passage and extension.

To the genius of Thomas Aquinas we are indebted for a clear statement of the distinction between the God of Aristotle and the God of the Catholic Church. The former, or Prime Mover, is as closely related to passage and extension as the latter, or Spirit, is, to idea and intention.

To prove the importance of the Divine (idea and intention), Thomas Aquinas laid the cornerstone of science by starting men to study the Natural (passage and extension), knowing well that sooner or later such a procedure would prove inadequate to explain experience. The success of his scheme was dependent upon the clarity of his distinction and the partial success of the natural sciences. Both required time.

The heresy of Bruno consisted chiefly in the fusion of the Natural and the Divine into a single world whose transcendent God was in no way separable from it, for Bruno had a mind for the concrete which precluded the acceptance of the ingenious separation of Thomas Aquinas. This marks both his greatness and his failure as a scientist. He prevented a rigid adherence to his forerunner's scheme. Concrete things were studied in a concrete world and it is not until the time of Newton that we find modern science emerging with the conception of the universe as inevitably determined by matter and motion. Natural science then came to mean passage and extension. Men no longer asked "why", expecting an eidetic or intentional answer from a scientist; but "how", expecting passage and extension. Science progressed rapidly to the final synthesis of matter and motion in energy. The distinction drawn by Thomas Aquinas had achieved at least half of what he desired. From the unsatisfactory perfection of that science the poets rebelled and the philosophers stood aloof.

NEWTONIAN MECHANICS. Mathematicians busied themselves with physical problems. They took idea and intention for granted. To many of them matter and motion were known only as mathematical entities represented for them symbolically. The work on electricity and magnetism, beginning in the experiments of Faraday and ending in the equations of Maxwell, is characteristic of this period in science. It gave a new approach to the problem of organizing scientific data. The equations of Maxwell displayed natural causation, so far as its metrical properties were concerned as a mathematical association in sequence. Scientists were not content with such relations and demanded the material ether as that in which waves passed. Experiment failed to discover the ether, but the mathematical propositions predicted what was actually found if consideration of the ether was entirely omitted. The equations related

energy in Newtonian space and time. These appeared as independent variables. The Newtonian conception of space and time did not prevent their natural, i. e., causal synthesis. The space was Euclidean and time flowed equally in measured lapses. The velocity of light in a vacuum was found to be constant. This yielded the missing relations of space and time which we will consider when we come to "relativity". What is of importance here is to note that physics had progressed to this point in the study of the material relations of things without the explicit introduction of mental relation.

STATISTICAL MECHANICS. The logician, Boole, attempting an important refinement of Aristotelian logic, quantified the predicate. Because in logic all things are either A or not A, and B or not B, it is possible to predicate independently of any one thing that it is either A or not A, and B or not B. This divided all things into four groups: A, B; A, not B; not A, B; not A, not B. It was now possible to count the numbers of things in any one of the four groups, and to study the numerical association of the predicables, A and B. This is the birth of statistics from logic.

The name came from the study of states with respect to wealth, man power, etc., where facts, not necessarily causally related, were correlated. The statistical procedure found its first great application in biology. Here it yielded the statistical conception of "causation"; the "cause" being the universal, antecedent, covariant predicable. But such statistical "causal" relations were normally absent in that the correlation was not universal. There were always some things that were A, not B; or B, not A; as well as those which were A, B; or not A, not B.

The theory of probability, as developed in relation to games of chance, was used to "explain" the discrepant findings. The combination of statistics and the theory of probability produced statistical mechanics. The fundamental notion in the theory of probability is that, given a limited group of possibilities and actual occurrences, some of the possibilities must be realized. This occurrence, presupposed in the theory of probability, is that which yields the proof required by the theory of probability; whereas, in the concept of statistical mechanics, the phenomena are supposed to be of such dimensions that the particular occurrences cannot be

discovered as such. Properly speaking the theory of probability, so robbed of proof, becomes the admission of ignorance — never to be mistaken for knowledge.

This mathematical theory was composed primarily of the predicables of Boole (pure ideas), their mathematical relations (pure intentions); but these, being divorced from physical significance, this theory of ignorance required the hypothesis of randomness as the quality of its material correlate. The result was an hiatus of a physical kind, a want of passage and extension, ending in a universe of discrete entities related by equations instead of by passage and extension. Yet the physical world, matter, was supposed to be driven and determined by passage and extension from which the predicables of Boole (ideas) and the mathematical relations (intentions) were forever excluded.

What seemed at first an introduction of the Divine into the Natural proved in the end the widest breach. The Divine and Natural worlds, the mental and material worlds, were so far separated as to demand a new synthesis. Seen from the point of view of thermo-dynamics, or statistical mechanics, some sort of God was requisite. Mental relations being specifically excluded from the universe, but the predicables of Boole (ideas) and the mathematical relations (intentions) being mistaken for that universe, God had to serve as passage and extension. The other alternative, namely that idea and intention were not mistaken for the physical world but that physical world strictly limited to passage and extension, the God requisite was the God of Thomas Aquinas, the idea and intention always there, in experience.

Apart from these consequences of the fallacy of misplaced concreteness, the theory of probability, as a quantitative statement of ignorance, has proved a profitable rationalization of intention. Its systematic application in the algebraic matrices, which have taken the place of mechanical models for atoms, has shown that a new constant, derived from experience, must be introduced every time that a new potential fact is to be derived from the theory. This algebra is noncommutative; that is, the order of operation is significant, though the duration required is negligible, but there is nothing to determine which order is correct. The results differ by an entity of small, but finite, magnitude. For such a

system of reasoning, this represents the limit of observable differences. In terms of this theory lesser magnitudes would be meaningless, unthinkable, indeterminate, nonexistent. This is that "ultimate" of which we must forever be ignorant, if we are to presuppose randomness in place of passage and extension, because we mistook the predicables of Boole for things; or equations, for material relations. Passage is related to the one-wayedness of the world and so to the serial order of operations; but this order of the world has failed to determine the serial order of the mathematical operations intended to represent it. That Maxwell had an uncanny foresight of such sequelae to statistical mechanics is proved by his caution concerning randomness; and, again, by his invention of the daemon who could exercise an intentional selection of particular variants of random motion. This daemon has served several quaint attempts to reconcile particular formulations of the second law of Thermodynamics with biological processes; many of which suggest that, with respect to living matter, many occurrences fail to exhibit that randomness which we, in our ignorance, have attributed to them.

BIOLOGY: Until recently biologists have been deceived less frequently than physicists by the apparent sundering of the "Natural" from the "Divine". There have been two reasons for this.

Historically, biology, springing full-fledged from the brain of Aristotle with an enormous factual equipment, had, as its organizing principle, the entelechy, or end-in-operation. Of two seeds, equally cared for, one became wheat and the other grass, if one was originally wheat and the other grass. A comparable finding existed for eggs. The young of any species became the adult of that species, not of some other. In the living of the seed, of the egg, of the young of any species was implicit the mature form as "final cause". The answer to the question, for what kind of bird is this the egg, was, naturally, the particular kind of bird that it would normally become – not some other. The living of that egg meant the becoming of that bird. Such a clear conception of potentiality was not achieved in physics until physicists, in order to have a law of the Conservation of Energy, postulated potential energy. Seen from this aspect, entelechy is the law of Conservation of Species. The energy which men experienced, like the bird that the egg would be, was

not the "efficient cause", but the "final cause", of the physical thing which possessed potential energy. The energy which the falling of a stone exhibits does not hold it in place before it falls any more than the bird that the egg will be keeps the parts of the egg in order. The "efficient cause", or passage, exhibits the one-wayedness of the world. The direction of intention is not so inevitably determined. Experience is only actual in the here and now, the past and future of which are given for and in it through intention. Science exists in the record and prediction of experience, past and to come. Neither physicist nor biologist supposes a reversal of passage when he argues from what is to what was, or expects what he does not know. His intending exhibits the passage of intention, real in the present moment, no matter what he intends. Intending exhibits the one-wayedness of the world: Intention does not. Entelechy, or the end-in-operation, like potential energy, completes an intentional systematization. It made it possible for Aristotle to reduce the outstanding varieties of organisms to a system of genus and species. His classification has stood the test of time and preserved, almost to our day, entelechy intact. Implicit in it is the conception of living as a process transcending any particular fact of previous structure. It is the notion of function in the widest biological sense of which growth, irritability, conductivity, and reproductivity constitute a partial analysis, being derivatives of the same process with respect to particular variables which are, themselves, not separable.

The second reason for the biological bridge over the widening chasm between the mental and the material is always new. Men, themselves, are living organisms and, except for polemical purposes, never deny that they have purposes; and even then, when they deny that they intend, they know that they intend to deny. This eternally present intention of the scientist in question frequently reminds him that, dealing with living organisms, he may be confronted with ones sufficiently like him to intend. As a scientist, he must be wary of attributing his own intentions to that which he is observing. But this is no valid reason for denying that the observed intends. What is requisite is the formulation of a criterion by which to decide whether a given observed intends or not. This has never been accomplished, though much behavior is predictable in terms of

intentions of the man – but not of the stone. In general, symbolic activity implies intentions, but few psychiatrists would be so bold as to suggest that that which behaved symbolically was necessarily aware of so intending. Relieved of its spurious halo of consciousness, intentionality appears closely related to adaptability on the one hand, entelechy on the other. For this reason we should expect to find intention characteristic of living organisms, more significantly in the more fully evolved. It was just by intending that those organisms who were good physicists, in the Comtian sense, won for us the ability to produce and distribute, of what we wanted, more than we could consume. No animal below man in the evolutionary scale has ever achieved so much by intention. No biologist can neglect their achievements by accepting their philosophy.

**BIOPHYSICS.** Physicists and Chemists have invaded the biological field without becoming biologists. They have attempted the study of structure and function in terms of passage and extension alone. They have obtained and organized innumerable facts of matter and motion of organisms and of parts of organisms. But most of them have failed to realize that they were dealing with only one aspect of a functioning entirety exhibiting entelechy and intention. Theirs is the fallacy of misplaced concreteness; that of supposing the material (passage and extension) to be a complete analysis of experience, as well as of the thing there for them in experience, even when the thing is a man, like themselves, capable of experiencing; while the physicists, in physics proper, have reached the comprehensive exposition of their simpler problem.

**RELATIVITY.** Having stumbled upon the constancy of the velocity of light in a vacuum while they were looking for the material ether, physicists were able to establish a quantity of space physically equivalent to a quantity of time, but the quantity of time imaginary; that is to say, directed perpendicularly to all dimensions of space.

Minkowski had evolved a four-dimensional continuum containing so-called world-lines, the intersections of which represented discoverable events. He treated time as an imaginary in the metric of the continuum.

Lorentz had produced the formula for the rotation of axes, as a quantitative statement of the requisite shortening of a body in the

direction of motion through the ether, to account for the constancy of the velocity of light.

In the theory of relativity, Einstein subsumes these diverse contributions by the use of definitions, in terms of operations, which showed that the distinction between space and time was not absolute but dependent upon the method of abstraction from experience. This led him to the conclusion that even serial order of facts in experience is determined by the relative motions of experienced and experiencer. Experiment has verified his predictions so that the general theory of relativity, with its metaphysical implications, has become the categorical necessity with which all physical laws must comply.

This theory, with the critique of Whitehead, showed that, for science, we must consider the mental and material relations not only from observer to observed, but from observer to observer; for, given these relations, it is possible to predict the observations of the one from the observations of the other. It is this explicit analysis of concrete experience, in which facts are related inter- and intra-personally, which is responsible for that community of agreement which Einstein has called truth.

CHAPTER III  
THE SCIENCE OF THE CONCRETE

ARGUMENT

**EXPERIENCE.** It is possible to describe, but it is not possible to define, experience. To each man there is an "it" that is happening of which he is somehow aware. Experience for any man is just what it is that is happening to him as he knows it. It is, for him, the universe that is concrete. Intended beyond it, are only extrapolations — however assured he may be of them; subsumed beneath it, are all presuppositions of reality; and above it, only that nothing on which it all depends. But any spatial analogy is misleading. What is important here is that experience is the totality which we would analyze because it is that totality of which any science is a partial.

**ALTERNATIVE MODES OF ANALYSIS.** This is sufficient to show that there are innumerable modes of analysis, each yielding entities which are, for it, elemental. No such set of entities is either right or wrong. It is just the set produced by that analysis. Errors arise when the elements produced by the analysis of one modality are confused with those of another.

The Aristotelian analysis was one which preserved the thinghood of its elements. These elements (called things) were concrete in all but that sense in which only facts are concrete in experience. Because of this lack of ultimate concreteness, for synthesizing facts again from things, other entities were requisite. These were called by him aitia (translated "causes"). Aitia ("causes") were the relations when things were the relata.

**RELATA AND RELATIONS.** It is characteristic of any mode of analysis that it must produce at least two types of entities; one, the obvious analytical elements, and the other, those by-no-means obvious entities which arise because the analysis was made in that particular manner in which it was made. These are, if you will, those entities which the resynthesis requires to produce the original. The

obvious elements are called the relata and the by-no-means obvious entities are called the relations of those relata. It is because the subsequent synthesis is that which requires the relations that the past participle appears in the words relata and relations and it is because there was an original which has to be synthesized again that the prefix "re" appears in the words relata and relation.

AITIA AS THE RELATIONS OF THINGS. The relata in the Aristotelian scheme are things (represented in primitive speech by nouns, such as the fire, the dog, the altar and the sword) which are now, as they were in the beginning, the obvious entities in experience. Aitia ("causes") were all those complex relations which things might bear to one another. Aristotle divided them into four major groups, translated "efficient," "material," "formal" and "final cause"; the Romans into two, "causa" and "forma," subsuming, respectively, "efficient" and "final causes," and "material" and "formal causes"; the English (and German) into two, here called matter (Materie) and mind (Seele) subsuming, respectively, "efficient" and "material causes," and "formal" and "final causes." Physics, with the critique of Whitehead, has clarified "efficient" and "material causes" as passage and extension; psychology has pointed the way to a similar critique of "formal" and "final cause," yielding idea and intention as we have used those terms.

The previous chapters have demonstrated systematically these developments in science clarifying the mental and material relations of things and they have indicated the possibility and utility of the concepts of Minding and Mattering which we shall attempt to formulate in this chapter.

AITIA AS ABSTRACT RELATA. For the generic notions we must return to the general problem of relata and relations, made specific in the attempt to analyze any concrete thing into its abstract relations. The possibility of such an analysis resides in the ultimate concreteness of facts the analysis of which by the inverse mode yields the aitia (causes) as the elements and their relation as thinghood. Such transformations are familiar to the mathematician and are always feasible if there exists an entity submitting to the alternative modes of analysis. It is just this procedure, predicated upon the togetherness of two modes of analysis,

which constitutes the intuition of the mathematician.

**CONCRETENESS OF THINGS.** Apart, then, from its thinghood, a given thing is analyzable into passage and extension, and idea and intention. These conjugate abstracta, mind and matter, analyze the thing of experience; and thinghood appears as the concreteness of the thing so analyzed. To attribute to either mind or matter the concreteness of the thing of experience is fallacious.

**INDUCTION.** There is an error which is prone to creep into logical discussions from the terra incognita of ontology. In order to preclude it, there is suggested in the Principia Mathematica that that which is common to all cannot be one of them. This law separates deduction from induction. Given relata and their relations, it is inappropriate to ask, what is the relation of the relations to the relata. To answer this would require that that which was by definition relation become relatum. Whether or not this may occur ultimately depends on the givenness of the original relata and their relations. If this is such that there exists an entity submitting to the alternative modes of analysis (so that those which appeared as relata appear as relations, and vice versa), then there exist relatively concrete entities whose concreteness will appear as a derivative conditional thinghood when what was originally relation is regarded as a relatum and vice versa. Such transformations are not logically permissible in deductive processes which necessarily proceed by predication, which is in general away from the concrete; whereas, in induction, not only are such transformations requisite, but justified by the thinghood implicit in the givenness when, and only when, this givenness is such that there is some entity submitting to the alternative mode of analysis. That is why the inductive process (the flight of imagination of Claude Bernard) yields for the scientist not a thesis, but a hypothesis, which, approached from the deductive standpoint, resembles the fallacies of illicit process of either premise or the undistributed middle term, but which actually arises because that which was common to all has become one of them, though not in the original sense. The change of sense brings us to the problem of the metabasis eis allo genos.

**METABASIS EIS ALLO GENOS.** When Aristotle schematized the world of known things in terms of the logic of genus and species, he was

confronted by a strange phenomenon. In passing from genus to species the relation was simply from all to some. But there arose such entities as differentia which were essentially the relation of genus and species as relata. But when he had to consider species and differentia as on some sort of equal footing in the definition of the genus, entities of one kind had to become entities of another kind. This is called the metabasis eis allo genos.

In essence the metabasis eis allo genos is always some transformation from relata to relation or vice versa. Because only a single entity was considered, the reciprocal transformation was wanting; and it was not immediately apparent that the metabasis eis allo genos was dependent upon the analysis in alternative modes of some more concrete entity, with respect to which relata and relations were abstract.

Let us compare this obscure statement, when a single entity is considered, with the obvious proposition, when both transformations are present. Suppose a man is given two stones and performs the following calculation: One and one equal two. Let us make explicit the four terms;  $\overline{\text{two}} \text{ Ones} = \text{one } \overline{\text{Two}}$ . Here we have, on the left side of the equation, two as adjective, Ones as noun; on the right side of the equation, one as adjective, Two as noun. So long as he has both stones "given," he may analyze it as two Ones (first mode) or one Two (second mode). If the nouns be understood as relata and the adjectives as relations, in the metabasis one exhibits the transition from relatum to relation, whereas Two exhibits the transition from relation to relatum. This is simply because the left side of the equation represents one mode of analysis, the right side the alternative mode. All mathematical identities are essentially statements predicated upon the givenness of some entity submitting to the alternative modes of analysis.

LOCALIZATION. For the primitive man simple calculations were possible because calculi were things exhibiting mental and material relations. He improved on the process when he substituted fingers for stones, marks for fingers and neural correlates for the marks. There must always have been something in his brain corresponding to the pebbles, mentally as well as materially. He has learnt to do without the pebbles, but it is inconceivable that he could do without something in his brain;

that is to say, he has substituted completely a thing in his head for a thing which originally required parts (pebbles or fingers or marks) outside of his head. Now there need be no passage of energy from pebbles to brain and from brain to pebbles. He thinks; and the process is completely within his head.

BRIEF. The problem is to trace the development of inductive reasoning (by means of this metabasis) from its Anlage in lower evolutionary forms to its present manifestation in social man.

## EVOLUTION

BEGINNINGS. It is no far cry from a professor to a lung-fish. As such, both are in a condition of intermediateness between what was and what is to be, not merely in the sense that both exhibit passage and extension, but in this, that the essential quality of both is that, in them, there is discernible that ambiguity derived from thinghood; namely, there is clearly implicit that which is given as intention in the relation of the things of experience. The major difference between the professor and the lung-fish is to be found in the professor's use of symbols, permitting reference of his intentions to himself. The professor can conceive that the lung-fish intends, as well as that he himself intends; in the lung-fish the apparatus for symbolic analysis and synthesis has not sufficiently evolved.

The advantage enjoyed by the professor has arisen largely through language in so far as he is a professor. The word is itself a thing whenever it is written or spoken or thought. At its best, it exhibits a universality and eternity of idea, in no wise dependent upon its particular appearance in time and space. It is just this once-for-allness, intended in all such words (that is to say, the riveting of attention to the mental aspects of the things called words) which has made possible logic. In this sense, words, whenever they appear, are the occasions (or events) for Platonic ideas (or Whiteheadian objects) in the universe of discourse. We habitually attempt to neglect, for logical purposes, the passage and extension involved in these things. They are related for us significantly by intention and of these intentions the "rules" are those of logic. As such, they are changeless relations of changeless entities.

In terms of words alone ontogeny could never be expressed or ontology defined. These demand passage and extension – not the ideas of passage and extension – but the relations of passage and extension among things (among which must be numbered words). Presumably for this reason Buddha found it necessary to hold his disciple under water and Samuel Johnson, to strike his foot against a stone. This is what Whitehead refers to as causal efficacy, to convey which even the professor is apt to resort to physical violence. It is matter, not mind. Here the professor and the lung-fish are equal, and it is here that we must look for the effective elements in ontology.

But the parallelism between the lung-fish and the professor extends still further. Each is, as it were, an exemplification of the process of "Phylogenesis," seeming anomalous among its well-adjusted neighbours – well-adjusted, but confined to evolutionary insignificance by the perfection of that adjustment to a smaller portion of the universe; for the lung-fish exemplified the transition from water-to air-breathing animals and the professor, that from common sense to philosophy.

ONTOGENY. It is one among many characteristics of experience that what it was, is and, will be are not the same. This Whitehead has called, "the creative advance of nature." The event that was there and then has passed into the event that is here and now. In the antecedent event certain Platonic ideas found their occasion. The events (passage and extension), together with the Whiteheadian objects (ideas) there in them for the experiencer, constitute the things intended by the thoughts of the experiencer. These things are not necessarily the same things as those of the second experience, though they are inevitably related to them by passage and extension. We have seen how Aristotle made use of intention to relate the eggs to the aftercoming chick and the chick to the full-grown bird. This exhibits two entities, the egg and the bird, different with respect to idea (Whiteheadian object) but related by intention as well as by passage and extension. That is to say, implicit in that egg is the potentiality of that bird which it actually becomes. There is one thing manifest early as an egg and late as a bird; that even which was qualitatively an egg has passed into that even which is qualitatively a bird. If it had not been fertilized it would have remained forever an egg. But, in

as much as it was fertilized, there appeared a condition of intermediate-ness between an egg and a bird; in other words, the passage from the event, egg, to the event, bird, required time; or, in still other words, there was a time during which it was equally appropriate, or inappropriate, to speak of it as an egg, or a bird; and this is true not only of the egg and of the bird, but of the *Anlage* of any entity and of its ultimate entity in that bird. Now, an unfertilized egg is capable of living, albeit in a quiescent form, for a very long time in a very specialized environment; whereas, the fertilized egg becomes what it was not, and is capable of living in a new environment. We do not think of the unfertilized egg as playing any part in evolution.

**ESSENTIAL NOVELTY.** The development of the bird from the egg is commonly referred to under the head of ontogeny, whereas the evolution of one species in another is commonly referred to as phylogeny. The reason for this is apparent. The birds lay eggs; the eggs become birds of the same kind. The whole process is reproductive so that, considered over a fairly long range of time, no new kind of entity appears. This is not so of that arising of one phylum in another. The first does not increase the total number of ideas (Platonic ideas, Whiteheadian objects), the second does; that is, there is an essential novelty in phylogenesis wanting in ontogenesis.

**PHYLOGENY.** The unfertilized egg is excluded from evolution because it never becomes anything but an egg. The fertilized egg is included because it becomes the bird that it was not (ontogenesis). If it yielded a bird of a species different from any preexisting species (phylogenesis), it would become that which never had been before it instead of merely that which it never had been before. For thing-minded man such distinctions have always been difficult. For him phylogeny seems a denial of ontogeny instead of seeming that which it is: The transcendental aspect of that entelechy which is fundamental to both, ontogeny and phylogeny, because entelechy is that in terms of which phylogeny itself is most easily understood. It is not any old species which gives rise to a given new one but only that species in which was already implicit the possibility of the required species. This may seem a complicated way of saying, simply, that the way in which new species arise from old ones is as truly orderly

as the way in which eggs hatch into birds; but it differs from such a statement in that it exhibits this orderliness as an analytical element of the full concreteness of experience rather than as a discovery of a mysterious law imposed upon things which one might have expected lawlessly together in experience.

**EMBRYOLOGY.** One frequently hears given as the law of embryology that ontogenesis recapitulates phylogenesis. This seems to follow as a natural consequence of the ontogenic process which is essentially repetitive except in so far as it is affected by environment. When there is a change brought about in some particular organism of a given species such that some tissue or organ, which had been elaborated through adaptation to its environment during the life of that particular organism, becomes hereditarily determined in the next generation, there has arisen a change of the phylogenetic type. If this alteration persists in ensuing generations, yielding a new species in the Aristotelian sense, then it is apparent that ontogenesis will exhibit this novel hereditary step of development as the last modification of those preexisting; that is to say, phylogenesis "capitulates" ontogenesis.

**TREND.** That changes of the type described produce organisms usually better adapted to their environment is self-apparent. They have, ab initio, what their ancestors had to acquire. We should therefore expect some organisms to become overspecialized for particular environments and that process, given still greater freedom to overspecialization by its achieved adequacy, to end in monstrosities such as overgrowths of weapons of offense or defense. A change in the reverse direction would usually yield organisms less adaptable because they would have to achieve in their lives what their ancestors had ab initio. Such monstrosities exist even among men and are commonly called throw-backs. It is, of course, conceivable that some alteration might occur determining for the next generation some entity of adaptive value not prefigured in its ancestors. A few years ago many such seemed possible in our ignorance of phylogenesis; but, wherever the evolutionary process is known in detail of fine gradations, they are absent. In their stead appears some modification given, ab initio, to the young which was foreshadowed in the ancestral adult, but which finds new functions in the light of new experience.

Organisms thus modified are in the ambiguous state.

### THE AMBIGUOUS STATE

**SIZE AND SHAPE.** There are certain advantages which accrue to an organism by increase of bulk, provided the activity of that bulk remains constant per unit volume; but the activity depends ultimately upon surfaces and hence necessitates an increase in area proportionate to volume — if the shape were held constant the volume would increase as the cube, and the surface as the square of any diameter of the organism. In order to secure an increase of area proportionate to an increase in volume, changes of shape are requisite, being convolutions of that surface. Very small organisms may be spherical, larger ones may be cylindrical; an external surface and relatively tubular gut suffice for the earthworm. Specialization of particular portions of these surfaces occur. All conceivable varieties of irregularities seem to have been tried. Among these was a pouch, or diverticulum, on the ventral aspect of the gut at its cephalic end, adjacent to the gill slits. Originally it was just a part of the alimentary tract, here specialized for the ingestion of food. It had a rich blood supply associated with that of the bronchial arches. Its extreme vascularity facilitated the absorption of soluble substances directly into the blood stream. Its size increased. It might have become a storehouse for food had not its vascularity been so great or had not the stomach already existed.

**SPECIALIZATION.** Two alternative uses were found for it, both of which were predicated upon its preexisting vascularity. (1) In some fish living in deep waters it became a bladder, ultimately divorced from its original connection with the gut. It served then as an organ to increase, or decrease, specific gravity thus enabling them to maintain their depth in the water or to sink by the absorption of gas from it through the blood vessels, or to rise by the secretion of gas from the blood vessels into it. This evolution terminated in the swim bladder. (2) In others, who lived in shallow, stagnant water where they could procure air from the surface, but not adequately from the water, it served to hold and absorb a bubble procured from above. This preserved them in seasons of drought when

they buried themselves in the mud and swallowed air extensively, distending the diverticulum and stimulating its blood supply. The diverticulum increased with use, its surface becoming more convoluted as it increased in bulk. Evolution in this direction culminated in the lung.

**THE AMBIGUITY.** This diverticulum at all stages has exhibited some function. Implicit in this organ situated where it was and highly vascularized, was the potentiality not only of its further development as an alimentary organ, but also of its development as an organ for dealing with gases — and this of two varieties, swim bladder or lung, neither of which was implicit potentially in any other diverticulum of that gut, and there were many. That is, there was a stage in evolution when certain organisms with this increasing diverticulum might tend in either of two directions; one left them fish, albeit with a swim bladder; the other gave rise to amphibia, reptiles, birds and mammals. At the parting of the ways the organism was in the ambiguous state. Its diverticulum might retain its alimentary function or further differentiate to deal with gases alone; and even those organisms in which it had become an organ for gases were still in the ambiguous state because the diverticulum had still retained the potentiality for swim bladder or lung.

**ADAPTATION.** Organisms in the ambiguous state have a great advantage over others with respect to adaptation. They may evolve in either of two ways, one of which may be essentially novel. Now, adaptation requires: (1) that the organism be capable of two or more modes of response to environment, (2) that, among these modes, one occur such that by it the organism continues to live, (3) that that mode of response become the preferred mode of response in ensuing reactions. This is, in essence, the same requirement as that determining evolution in all cases, whether we consider the evolution of individuals or of species.

**MUTATIONS.** As yet we do not know in any case how mutations arise, though we occasionally produce them. Not long ago the same might be said of the production of variants of response. Of both mutations and variations of response, we do know that that which we may obtain is determined in large measure by that with which we have to start.

**SELECTION.** The second requirement is by no means always fulfilled by occurrences of the first type. Dominant albinism, which appears as a

mutation among certain varieties of small fish, generally ensured the death of the mutant; certain acquired variations of behavior, such as leaping from high places, usually end in death. The mutations from alimentary diverticulum to lung, like the study of mathematics by the physicist, are obvious examples of the successful type.

REPETITION. The third requirement seems far more likely to be fulfilled than the second; but a study of triploiding, tetraploiding, etc., and of hardy hybrids, shows that, though the change may resemble a mutation, it is not necessarily transmissible and may even preclude the possibility of those offspring requisite for its continuous repetition. The same is true of many successful operations performed, but not repeatable, by the performer.

PHYLOGENETIC IMPORTANCE OF THE AMBIGUOUS STATE. Yet these prerequisites of adaptation are insufficient in the case of evolution. For this the ambiguous state is necessary. Only from organisms in the ambiguous state can we expect adaptations to a new kind of entity. Even here the novelty is not as great as it seems. The fish had always to deal with gases; but before, those gases existed in solution, whereas after the ambiguous state they existed alone. When the fish dealt with them in solution there is hardly any possibility that he could have distinguished them as different from the water that passed through his gill slits. There may have been qualitative differences for him between water rich in air and water poor in air, for these were affectively related to him. This qualitative difference, or the corresponding affect, was the only precursor of air as air for him.

#### ORIGIN OF IDEA AND INTENTION

SIGNIFICANCE OF THE NERVOUS SYSTEM. In no organ other than the nervous system does ontogeny recapitulate phylogeny with the same exquisite faithfulness of fine gradations. This is possibly so because no other organ has been so significant in adaptation or presented so habitually the ambiguous state. It is enough for our purpose here to show how the shift was possible in neural function from direct response to symbolic behavior.

SYMBOLIC IMPLICIT. That such a shift has occurred suggests that symbolism which occurs as such in this text for writer and reader was implicit in the mode of behavior which appears as direct. In other words: we would expect to find in the behavior of more ancient types that certain activities were more symbolic than others. As a matter of fact we find symbolizing, like gaseous interchange, always present in organisms. Our lungs have evolved as the organs of respiration, and our brain as the organs of symbolizing. The significant difference is this, that the gills have been replaced by the lungs whereas the nervous system retained its role of significance.

SYMBOLEIN. The nervous system is that part of the organism which is differentiated for the conduction of physico-chemical disturbances from one part of the organism to the other. It produces a disturbance in one end which originated at the other. This is representation neurally of events presented extraneurally. At the site of representation it may encounter other disturbances (original or represented there). This is "symbolein," the coming together by representation of entities originally separate. When the response of the organism is initiated by such a coming together within it of entities originally separate, it is legitimate to speak of that activity as "symbolic" – albeit in its most primitive form.

DIFFERENTIATION AND INTEGRATION. When particular combinations of representative disturbances are requisite for different types of response, differentiation has begun. This happens far down in the evolutionary hierarchy. The nervous system begins in a relatively diffuse fashion and retains, even in the highest forms, innumerable interconnections effecting integration, originally by totalizing the behavior (and this is never entirely lost) and later by yielding particular integrals by recombining specific differential components, themselves integral with respect to higher orders of derivatives.

SPECIALIZATION OF RECEPTORS. Evolution at the receptive end occurred, yielding sense organs. These sense organs were not all alike. At one time they exhibited the ambiguous state. Some were specialized for pressure, others for light touch, others for changes in temperature, some for change toward the higher and some, toward the lower end of the scale. Still others differentiated for chemical interaction with the

environment, yielding smell and taste. Still another group differentiated for electromagnetic waves yielding sight. Among the groups originally differentiated for physical contact (touch and pressure) a still further differentiation occurred, yielding an organ particularly responsive to the vibrations of the air and another susceptible to changes in pressure due to motion and position — the cochlear and vestibular apparatus. But we do not need to follow these developments in particular. They exemplify no new principle.

ORIGIN OF ETERNAL OBJECTS. What is important for us now is that, when such an organism passed from a hot to a cold place, all of the receptors of decrement of temperature were thrown into activity together making possible by the representation of the disturbance of the separate organs the response to falling temperature as such. Careful study of this specificity of the sense organs themselves demonstrates how many qualities of the universe are determined by them, and the study of the corresponding neural arrangements shows how segregated the structures associated with each become. Each such quality is an idea (Platonic idea, Whiteheadian object) to which corresponds a differential element of neural structure.

But these structures in higher organisms are represented again and again neurally at the so-called higher levels making possible new differentiations in each type of experience.

ORIGIN OF ENDURING OBJECTS. We return to another origin of "Platonic ideas." Sense organs are scattered through the volume occupied by the organism. When a given complex of these are stimulated by some ordinary thing, say a pencil, and then this same thing is rapidly transferred to other parts of the body, stimulating successively complexes of end-organs, the neural disturbance representing the first stimulation by that thing has not completely disappeared when the next complex arrives. The result is that there is, in that organism, one prolonged disturbance in the central nervous system corresponding to "the pencil." Now, the nervous system is an adaptive mechanism able to preserve a trace of its previous behavior such that aftercoming behavior tends to follow the original pattern. Thus it is possible for the organism to respond to the pencil as such on a subsequent occasion. Such common things are characterized

for that organism by a "Platonic idea" which again corresponds to structure within the organism. This means that with respect to this "pattern" of stimulation there will correspond a "pattern" of response. It can be shown, as for example in the case of the ear, how there can correspond a structure to a particular type of succession in time. The same is so of relation in space, most easily followed from the kinaesthetic sources, but also obvious in the eye.

So much for the neural correlates of Platonic ideas. They are analytical elements of experience; their neural correlates are differential elements of structure.

INTENTION IMPLICIT IN THE EXISTENCE OF IDEAS. But intention as well as idea has its neural correlate discernible in the fundamental neural activity, *symbolein*, from the stage in which it is implicit to that in which it appears in logical demonstration. Representation in the sense in which a disturbance at one end of the neuron is represented at the other, implies the identity of the disturbance throughout. That cold, which the organism experienced no matter which of these receptors for decrement of temperature was stimulated, exhibits identity of ultimate disturbance to a multiplicity of initial disturbances — in this case multiplicity "of which" sense organs, but not "of what kind." With respect to this idea all those events were identical, however otherwise dissimilar.

ANTICIPATION, FREEDOM AND ERROR. Now let us return to the experience with the pencil. I pick up the pencil and am beginning to react neurally to it as usual. It has been lying on the window sill. I start writing. But the metal end comes against my hand and the reaction to cold appears suddenly. The neural activity associated with the pencil had not been such as to include the response to cold before. Warmth had been implicitly there. I was startled and realized that I had expected it to be warm. This exemplifies expectation as the tendency of neural activity to run in its previous pattern. The organism reacts as if, on the present occasion, events followed their former course. When the time intervals required for the neural processes are less than those of the extraneural even (which frequently happens) the neural activity anticipates the extraneural activity. This dependence of neural activity upon

immediate external events, carrying with it by implication that it may (or may not) correspond to that external event, makes it possible for the organism to adapt in an unusually successful manner (or in an unusually unsuccessful manner) to its immediate environment. These sudden successes and failures, entailing sudden changes in the quality and distribution of immediate aftercoming neural disturbances which either reenforce the original if successful or disrupt it if unsuccessful, have themselves led to neural representation in structure until we now have for them ideas.

**INTENTION EXPLICIT.** When Aristotle saw a certain kind of egg, he expected a certain kind of bird. It was not that bird, but it might become that bird. The immediate stimulation yielded "the egg." The anticipatory activity from that stimulation yielded the bird. They were wont to occur seriatim together in experience as external to Aristotle's organism; so for him the egg implied the bird. The egg was the symbol for the bird. If I say "Kau" to you and point at a cow, it will not be long before your neural activity is such that the sound "Kau" causes you to anticipate the cow — not necessarily as existing beyond you, as the thing, but the idea of that thing will be there for you. The sound "Kau" will mean the cow. The relation of the sound to the animal will have become purely intentional. Representation by bringing together entities originally separate in space and time has, in anticipation, made it possible for one thing to stand for another regardless of space and time. This is the significant relation of symbols called intention.

**TREND.** The evolution of the nervous system is toward more specific and diversified differential elements of experience of the eidetic type together with diversification and facilitation of anticipatory reactions of the intentional type.

## MATTERING

**TO WHOM IT MATTERS.** Ontogeny recapitulates phylogeny in the person of the elephant. He stood in the front of his cage and raised his trunk as I approached. I did not give him anything, others had. He swung his trunk slowly down and up to his mouth as if he had received food and then back to the original position as if to receive. This is a

gesture learnt by him in his lifetime. The motion is simply that of receiving and conveying food to his mouth. The gesture occurred as I approached. He had received no food but the trunk swung to the mouth. This anticipatory activity served a new end. It had become a successful mode of begging. It was repeated whenever he was approached and when it was successful was repeated, serving its original end. Such gestures are one origin of language, serving to convey the idea of the anticipatory nervous activity to an organism other than that in which it occurred. But such gestures are still ambiguous. The elephant behaved as he did because the gesture was effective and the change brought about beyond him affected him by contributing reinforcement to the process underway. But this is no reason to believe that he knew how it worked. The man who feeds him knows that the elephant desires food; but not the elephant, that this is why he receives it. The gesture symbolizes the neural activity of the elephant for the man but not for the elephant.

**EMOTION.** A dog howls. This in itself is not a particularly efficient way of getting things done. Originally little more than a forced expiration, it has become biologically important in attracting others of his kind when he needs assistance. Originally he howls when there are stimuli sufficient to produce forced expiration. But the act itself produces a sound which, in turn, adds impulses to his neural process then underway. There was some idea, let us suppose the pang of hunger, present in him at that time. Its neural correlate received a component from audition. There is every reason to expect the howling to continue at least as long as the pangs are present, though stimuli of the type from which they originated have ceased. Actions of this kind constitute emotion in as much as they exhibit this tendency to self-continuation, making them difficult to control.

**FEELING.** The ideas associated with emotions are of the type usually called feelings (pathos). They vary from those of great specificity, such as hunger pangs, to the most general sense of well or ill being. They always have neural components derived from enterceptors and, consequently, these feelings may be referred to the organism as its feeling of itself.

**SYMPATHY.** The whelp howls and the bitch hears it. She herself has howled in the pangs of hunger; the howlings of her pup transmits to

her ear, and thence to her nervous system, disturbances whose pattern is such as to arouse in her that neural activity whose idea is the hunger pang. Thus the idea of (the feeling of) the whelp is transmitted to the bitch. She feels as the pup feels. This is sympathy. It exhibits the material relation from mind to mind.

IMPORT. But the example yields more than this. The howling is proceeding from the thing there and then in experience for that bitch. The howling, the whelp and the pang in the bitch occur together in experience for that bitch and her reaction is determined by all of these together. Under normal circumstances there is present also a distension of her mammary glands with its covariant impulses and the corresponding feelings. Among other responses she suckles her whelp. The howling ceases and she is relieved of the pangs of distension and of the sympathetic pangs of hunger. All this is now phylogenetically determined for the individual and consequently facile. Of a normal dog one might be tempted to state, that she made the proper reference of the hunger pang to the pup. But this is not necessarily so. We are dealing as usual with the ambiguous state. The bitch may never have become for herself a thing in her experience, though the pup has. Of the howling pup, her pang seems a quality. There is no true reference by her because there has been no separation for her.

AFFECT. The biological efficiency of the howl lies in this, that it has procured the food for the young by means of sympathy. It is affective with respect to the bitch; for it aroused feeling in her, whereas feelings are just those ideas which normally arise from the disturbances initiated in enteroceptors; that is, we are dealing here with the process which, when the organism has distinguished itself as a thing, makes it realize that other things matter to it, in as much as it feels itself changed by them.

UNANIMITY. When one hound bays at the moon, others begin to bay. These have heard the first; when they had bayed at the moon they had heard themselves baying and this stimulation had augmented the original process. Now the hearing of baying itself had become sufficient stimulation for baying. Their behavior became a replica of the hound who bayed first. They had bayed at the moon and the moon had its neural

representation in them. Thus they all bayed at the moon, though at the time of this baying only one need have seen it. The idea is there in the neural processes of all. This unity of idea, present during the conjoined baying, constitutes unanimity in common action which plays so large a part even in human behavior. Such expressions are essentially emotional and sympathetic and the identity of the idea for all members of the crowd is ensured only in so far as their experiences of objects beyond themselves have been identical. This is not imitation no matter how closely it may seem to resemble it.

IMITATION. There are many species of birds which have songs of their own completely determined for the individual phylogenetically. There are other species which have characteristic songs of their own but which, when the young are reared in the nests of other birds, exhibit a capacity for singing the songs of foster parents. Still other species are so prone to acquire the songs of others that they seem to have none of their own. And last; there are some, notably parrots, whose vocal productions resemble those of animals other than birds, reproducing sounds as complex as those of human speech. The reproduction of sounds characteristic of other animals is a form of imitation. It remains to show how imitations arise. It is obvious that, with respect to it, some birds are in the ambiguous state. In others mimicry has developed apparently as an end in itself; whereas, in the complicated flights of starlings and crows its use in directing group activity is well known. What is requisite is that the bird, to mimic, should have a tendency to produce sound rather than some particular sound; that he produce sounds and that their occurrence occasion the continuance of his activity; that he hear sounds other than his own which determine specific ideas for him; and that, when he produced sounds, those which intensified the neural activity determined by audition of alien sounds become, by that reinforcement, the characteristic mode of response. Again, this requires nothing essentially new of the nervous system, only greater differentiation of structure with preservation of integrity. Mimicry is not limited to the production of sounds; bodily postures and motions are frequently reproduced. These demonstrate pattern perceived by one sense, reproduced by organs primarily associated with others. Modeling, painting and

drawing of things seen are explainable in the same way. From these arise the ideographic elements in language.

**HISTRIONIC SYMPATHY.** Now mimicry of this type does not necessarily imply sympathy. The organism in addition to the idea of that which he mimics may, or may not, feel as he would if he were it. In the case of pantomime he probably does, but when he paints a tree he probably does not. If the imitation be at all adequate to the original, it may exhibit for some other organism the idea of the original and he may respond to it as he did to the original. If the original was affective to either imitator or observer, it would be in kind to the other in so far as they were similar. Sympathy may thus appear of a secondary, rather than a primary, variety.

**EMPATHY.** Such sympathy must be distinguished from empathy, which is the feeling arising in imitating whether or not it is that of the imitated. Where the object in question is a work of art, say, a statue, the beholder, in his partial imitation, experiences empathy with respect to the statue; the feeling itself may be the same as that aroused in the sculptor; thus, empathy, with respect to the statue, may be sympathy, with respect to the sculptor. The affective side is never entirely lost.

## MINDING

**INDICATIVE GESTURE.** When the leading hound opens cry and begins to give chase, the whole pack goes into action. That it goes into action with the chase in mind is an example of unanimity in action — but it is more than this. The action is directed by the orientation and direction of motion of the leader toward the prey. The action of the leader is an indicative gesture, directing the pack toward the prey. The pointer and setter are so called because their characteristic postures are indicative gestures recognized as such by the hunter. The same use has given rise to the name index finger. The corresponding cries gave rise to the old imperative mode and the demonstrative pronouns, this and that.

**ORIGIN OF INTELLECT.** All indicative gestures, from the most primitive to the most elaborate and refined, even sample and example, preserve in demonstration their hortatory value. They are affective to the percipient, compelling him (by imitation) to attend to that to which the

gesture points. But the attention is focussed on the thing intended rather than on the affective aspect of the observed gesture. He feels that he must look at that which is indicated. No new principle is exemplified in the origin of indicative gestures — though in them, for the first time, intention becomes explicit. The separation of affect and idea is the beginning of critique of the intellectual type.

**IDEA OF INTENDED — AFFECT TO INTENDING.** For the observer of an indicative gesture it is possible to distinguish and relate symbolic activity of the symbolizer to the thing given symbolically in that behavior. But what happens in the observer is more important than this. For the first time the affect is that to intending; whereas, the idea is that of the intended; the idea of intending arises as an entity separate from the intended.

**THINKING.** That integrative process of the nervous system, in which the relata are ideas of entities intended and the relating is intending, is called thinking.

Acts of this type exhibit intending as the characteristic psychic activity of the thinker. Thinking so defined is that for which Hughlings Jackson has correctly coined the word *pro-posit-ion-al-iz-ing*. Complex indicative gestures representing it are called propositions because they stand for what they are not — except by intention.

**LANGUAGE.** Human language exemplifies this in a complicated form. Historically, it shows the development of ideograms from pictures, and of spoken words from natural outcries, and of imitations associated with indicative gestures, and lastly, the representation of these by means of ideograms. But this last is not complete and there exist many ideograms to which no, or many, sounds correspond.

**GRAMMAR.** It would be useless to trace here in detail how language evolved to exhibit grammar as an analysis of speech, into relations and the related parts of speech, in a proposition. In as much as we are interested to show the origin of categories, as determined by the nature of thinking itself, it is necessary for us to study propositions grammatically, but only sufficient to do so as long as we remember the intentional relation of the proposition to that of which it is the proposition. This is apparent as such only in those concrete propositions of experience that are composed

of three terms; as, "I saw him die," "I saw that he was dead," "I wish that he were here" in the last of which intention is explicit in the conjunction "that," but implicit in the other two. The ordinary factual proposition, such as "the dog bit the man," is meaningless apart from its relation to that which is intended by the intender of whom it is the intention. Thus the conjunctions of propositions of the factual type, whether explicit in particular words or implicit in the juxtaposition of propositions conveyed by change in the mood of the verb, or suggested only in the totality of that experience in which the proposer, proposition and proposed are given, signify intention — which is just that relation. The factual proposition stands for an entity in experience. As such it presents a concreteness greater than that signified by any of its parts, though not as great as is exhibited in those expressions, in which factual propositions are conjoined so as to include intention. Nouns are the names of those things which they represent (by intention) in the propositions in which they occur; things are next in order of concreteness to facts. In factual propositions nouns are related by verbs, the most primitive of which are transitive, implying that activity initiated in the thing signified by the noun, called the grammatical subject, eventuated in activity in the thing signified by the noun, called the grammatical object. As such verbs always carry with them the notion of passing from one entity to another, however these entities may be qualified. These verbs, as such, symbolize the irreversible changing of experience. Presumably because by this irreversibility time itself is distinguished, the time relation appears in the tense of the verb. Space, like time, is a derivative from the relation of whole and part, called extension, but spatial relations, as such, appear first in the primitive preposition. Only late in the development of language do these prepositions receive temporal significance. Adjectives, and all adjectival expressions qualifying any part of speech, signify that there and then in experience some idea existed.

CATEGORIES. Categories arise in the attempt to analyze experience in terms of experiencing. Categories are not classes of experience. They are those entities in terms of which experience can be propositionalized. Here the ontological difficulty appears, because the experience of propositionalizing is necessarily included in the totality of experience.

Presumably for this reason all schemes of categories seem unsatisfactory.

Aristotle began with a large number and no apparent scheme, but there is apparent a drift toward those entities symbolized in speech by the grammatical parts of speech; that is, the analysis of experience by propositions. Rationalizing was naturally attempted in terms of analysis of the proposition. It might have progressed further in this direction had it not been for the complexity of Greek verbs and the appearance of entities which were substantives only by virtue of the metabasis.

EVOLUTION OF THE UNIVERSE OF DISCOURSE. Our whole discussion has been an analysis of experience in which the analytical elements exhibited various degrees of concreteness from that of the totality of experience — through that of related facts — to that of related things constituting the fact. We have subsumed passage, extension, idea, intention; but we have also subsumed the thing, as requisite for the description of the fact. If all we desired to do was to describe the fact, the subsistence of these would suffice. To them the Aristotelian logic is applicable and, with the postulate that that which is common to all cannot be one of them, it is adequate in so far as we are concerned with the intentional relation of ideas as predicable of things. But the relation of facts transcends such a scheme. Related facts do constitute the totality of experience. Their relation transcends the domain of logic at the time, in the place, of the actual metabasis. Here we are concerned with creation, not in the sense of the exhibition of a variety of ideas distributed hither and yon in particular patterns, but with essential novelty. The creature is a new timeless entity — a new idea which, as soon as it has been created, must obey the laws of logic. It frequently happens that entities are "definable" which cannot exist. Of these the classic example is the class of all those classes which do not contain themselves as members. In such cases the definition is deceptive, for the entity defined cannot arise. The fallacy is ontological, not logical. As in the ambiguous state, we have described those organisms in which the metabasis is in process of occurring; the problem was ontological, not logical; for logic is a law relating created ideas, whereas ontology is the law of the creation of entities. Ideas and intentions are mental entities which, taken together as relata and relation, constitute mind — just as passage and extension constitute matter. Logic is the -

once-for-all-relation of mental entities. As such it may be known but it cannot be understood except in terms of its creation:

UNDERSTANDING. When we attempt to describe aitia (translated causes) and things we attempt to find some name applicable to them all. This is because we understand them ontogenetically; that is, as arising by a particular mode of analysis of the concrete (fact) as relata and relation and as relation and relata by the alternative mode of analysis. It is entities so conceived, as transcending relata and relation, which exhibit themselves in the metabasis eis allo genos, now in one category, now in another. Ideas are necessarily adjectival, passage verbal, extension prepositional, intention conjunctural, though by virtue of the metabasis it is possible for us to substantialize them. But entities so substantialized are not things, though they appear as nouns in prepositions. If the original entity is mental, that which intended remains mental; the only passage and extension (matter) which it possesses are of, and in, the propositionalizing and the proposition. And here the propositionalizing is ontic when the proposition exhibits a novel idea. It is creative thinking when the novel idea is not illusive but submits to the logos. To keep the discussion mundane; this distinguishes understanding and creative thinking from memorizing and the application of rules, that the laws of the first are ontological and, of the second, logical.

THE EVOLUTION OF LOGIC. That science should start with the stars and end with man – that logic should start with the copulative and end with verbs of sentiment – suggests that the stars and the copulative could be viewed more dispassionately; for relations less affective permit a restriction of the affect to intending, so sacrificing importance for clarity. To say, "the moon is white" probably required centuries of intuitive abstraction after man had learnt to say, "I love you." Quite the reverse is true of their logical analysis. Logic has been largely restricted to the mental relations of mental entities, propositions have not. Consequently, logic has been found applicable to a restricted group of propositions. The simple proposition, composed of two terms and the copulative, together with certain modifications, such as all or some, no, not and none, considered by Aristotle were the only propositions submitting to logic until the days of Boole who quantified the second term, or predicate.

Not until the beginning of this century were relations other than those represented by the copulative considered. These were divided into major groups, as symmetrical, reflexive and transitive and these in turn subdivided. This was a great emancipation for the logician and was followed rapidly by the logic of propositional functions, or propositions neither true nor false, but capable of being transformed into propositions, true or false, by a loss of universality through restriction to specific entities. Such developments were necessitated by the attempt to reduce mathematics to logical formulations. To ask whether a mathematical proposition is true or false, as opposed to whether it is consistent with the rest of mathematics, is to ask whether or not it conforms to the fact of our experience of things. It is like asking whether or not the moon is white. Now, "the moon" is a thing to which men, being organisms, react neutrally. A particular pattern of neural response corresponds to the moon, to the snow, to sea foam and to the proposition, stands for a thing to which "is white" is adjectival. Logic has not been concerned with whether or not the proposition corresponded to experience (with "matters of fact"). It has handled the proposition, "the moon is white," as though "the moon" were a mental entity of the same kind as "white." This was justified only in so far as both were regarded as ideas, substantialized only in the proposition. "Socrates is a man" (minor premise), and "all men are mortals" (major premise), therefore "Socrates is mortal" (conclusion), implies a metabasis concealed behind the relation of all and some. "Is a man" is adjectival to "Socrates," just in so far as we are dealing with Socrates who began as a zygote to end as a corpse, for we deduce from "man," as here used, that Socrates was mortal. The idea (Platonic idea, Whiteheadian object) is obviously not mortal: "Socrates," qua idea, is not mortal. But in the major premise, "all men are mortal," "men" refers to things, to all of which "are mortals" is adjectival. This represents a change of the middle term ("men") from an adjectival entity to that entity substantialized. Thus, it is an example of the metabasis eis allo genos. "The moon" is an entity and "white" is an entity; and the metabasis, always in use without recognition, confused the logician, to whom it seemed a matter of some and all. Every predication concerning a predicable — and all such syllogisms are cases in point — conceals the thinking in

expressing the thought. (For the thinking usually progresses from the minor to the major premise and thence, to the conclusion; but formal logic from the major, to the minor, and so, to the conclusion.) But this concealed thinking is that which is responsible for that inward click of certainty in the conclusion (which seems to be our self-reflexive déjà-vu; perhaps the type of neural reenforcement which arises most clearly for us when our anticipatory reactions, having gone right, are reenforced in the fact).

It might seem that in mathematics, in as much as it is the theme of themes, in which all of these entities which are intended are the ideas of foregone intendings, no metabasis was requisite. That such is not the case, is shown by the example, two Ones equal one Two. Mathematical reasoning is thinking, not always merely the application of rules, but frequently creative thinking. This is evidenced by the new themes it has produced. These in turn have submitted to logical analysis and this process is responsible in large measure for the origin of the logic of system-function; but this, as all varieties of logic, so far considered, concerns itself with created entities rather than with their creation. It is an abstract science rather than a science of abstraction.

## THE LOGICAL STRUCTURE OF MIND

**FACT.** As physicists had to have an ether to transmit waves, because mathematical equations of wave form related observations correctly, so Plato, noting the appearance of new ideas (new eternal forms), supposed them to have "endured" in the "Sun." We have tried to show how novel ideas arise from the neural activity of those for whom they appear in the creative advance of the world. In order to do so, we have made use of the alternative modes of analysis together with subsequent synthesis. The possibility of such a neural activity is proved by our having done so. That is a matter of fact.

**OTHER LIMITATIONS.** Facts do submit to alternative modes of analysis. They are given in a sense more concrete than that in which relata or relation are given. We cannot change the past. It is past, fact. But our experience of the world exhibits another changelessness which

like facts, cannot be altered, but may be disregarded. It is to be distinguished from the laws of science, in that the laws of science are discoverable within the given fact. That "I am I" and "You are you" are given, immediately, as restrictions of possibility comparable to that concerning the past. This type of givenness is rather prerequisite for all experience than for particular sequences, or arrangements, within experience. The particular facts are susceptible of alternative modes of analysis; but this, as a limitation of possibilities of experience, is too concrete for us to transubstantiate the correlative relations of them into relata. It may be that experience does not submit to the alternative mode of analysis. It is enough for our purpose that facts do. Our concern is with the logical structure of mind rather than with the sublimity of such a limitation.

REFERENCE OF MIND TO MATTER. Mind is not a thing. A mind does not occupy space through time. A brain does. It is theoretically possible for two men to be of one mind; not — of one brain. Such concreteness as is attributed to a given mind is done so in the metabasis or by reference of the mind in question to a singular, particular matter, the body. Let us consider a physicist making an observation. He is concerned with the passage and extension of the observed. He refers idea and intention to it with great exactitude. When the pointer on the dial reaches the number 23, that means to him that the water is at that temperature, or the gas at that pressure, or the potential that many volts, according to the passage and extension involved in his experiment. But he attempts to neglect idea and intention as of the observed and restricts his symbols, as far as possible, to refer to passage and extension as such. The idea and intention were his own. But he then indulges in what he would consider a purely mental affair; that is, the mathematical relating of ideas and intentions. The result is an hiatus, apparent but not real, between the observation and the mathematics. In both cases, he and the entities with which he was concerned were mental and material. They were concrete in experience, but by a shift in attention he was able to abstract either aspect and neglect momentarily the other. For him this process has usually been successful, though there are instances, like that of the ether, in which he has supposed concreteness

without warrant. The theory of relativity, with its experimental verification, has brought to light several such fallacies of misplaced concreteness. When we turn to the mathematical procedures of the mathematicians themselves we find that they tend to neglect the passage and extension of their own brains, or at least to pay insufficient attention to them, as is witnessed by the rise of the intuitionistic school of Brouwer and Weyl. They are definitely concerned with thinking about the same entity in two ways at once, but refer the concreteness to the universe of discourse as the continuum which is both all and some, and whole and part; that is, they suppose that which is given intuitively to be both mental and material.

**MATHEMATICS AS LOGIC.** Mathematics, aside from this intuition which is apparently the metabasis, is essentially logic in origin and specific symbology, adding to logic premises productive of relations of increasing complexity. That mathematics is thought to be essentially different from logic seems to have arisen because mathematics attributed to entities, which had undergone metabasis, concreteness comparable to that of the entities from which mathematical entities were originally abstracted.

**LOGICAL STRUCTURE OF MIND IN MINDING.** Ideally, the physicist regards himself as affected during the period of observation; that is, it matters to him. Ideally, he regards himself as minding it later, during his mathematical period. It is during this later period that the characteristically "psychic processes" dominate the organism (the physicist); it is at this time that actpsychology, as phenomenology, would form the significant analysis. His mind, so conceived, would show a relatively obvious system of intentions. The ideas themselves would be those of previous intentions. It would be legitimate to ignore, minimize or bracket the contribution of the external world. His feelings and the recollection of his sensations would be of little more significance and would appear illusory affairs. At this time the logical structure of his mind would be most apparent to him.

**LOGICAL STRUCTURE OF MIND IN MATTERING.** It is the fond hope of the physicist that, during the observational period, all psychic processes, other than those determined in him by the energy received

from the apparatus, are held in abeyance. He would like to look upon himself as a tabula rasa on which the observed phenomenon inscribed itself; but this is forever precluded by his anticipatory reactions requisite for the question he has put to nature. The particular experience, called observation, is not one in which the observed is alone effective in the observer, but one in which it is affective to the observer. The experience is such as to reenforce, or fail to reenforce, anticipatory neural activities already under way. That these, themselves, are of the propositional type is apparent explicitly in the use of such terms as indicator, pointer, dial. Idea and intention cannot be excluded — for observation itself has its psychic aspect. The logic for handling the mathematical propositions is already extant, but that for handling the simplest propositions of the observational sciences is still to seek.

LOGIC OF FACTUAL PROPOSITIONS. "I see green," "it hurt me," "the dog bit the man" are propositions of this type in which the verb is transitive. These propositions are factual; they are not predications concerning the subject but stand for the facts themselves. Combinations of these do not yield syllogisms by predication of predicables. In a certain sense all observational sciences, in so far as they approach the formulation of laws governing the relation of such proposed entities, are preparing the way for the logic of factual verbs; but, in another sense, the relation of such propositions is predetermined by the mere givenness of fact. This givenness is of the once-for-all type. It is, however, such that the problem of truth can never be excluded as it can in the familiar varieties of logic. These propositions are relatively concrete; there is another group, equally concrete, of complexity equivalent to that of propositional functions. We refer to those of sentiment: "I love him," "I obey him," "I like it"; and still another group more complex in form; "I believe that he will die," "I hope that he will live," "I know that it killed him," "I spoke that you might know that it was true," in which relation of sub- and superordination appears, for which reason these latter are more closely related to the entities considered in the logic of system functions. Our habit of drawing conclusions from these concrete propositions, singly or in combinations, yields anticipatory activities confirmed in subsequent experience. Inasmuch as the propositions are true, we can and do reason

correctly by means of them. The processes are habitual. In that is implicit a once-for-allness of those intentional relata; in other words, there exists the possibility of a formal logic applicable to them.

FOR WHOM IT IS TRUE. Let us consider the proposition "I see a purple cow." It may, or may not, be true. To say that it is true means that it proposes an actual experience, for the proposition is factual. Let us suppose it true. Implicit in this supposition is that there was some one (I) to whom the cow was purple. Purple is an idea. It is adjectival to the cow for that observer. It is adverbial to that particular portion of the experience (of seeing that cow) for that observer. It is predicable, concerning that pattern of his neural activity, that it is purple for him. Provided we keep clear that it is for him — it would be equally proper to refer the mental entity purple to the cow, to the seeing or to the I of the speaker; whereas, for some other observer (supposing that he could observe the neural process, the seeing, and the cow of the first observer) it would be obviously erroneous for him to expect that the neural process, or the seeing, would be purple to him, even if the cow was. Under such circumstances he would probably admit that the reference of purple to the cow was correct, but disagree with its reference to the seeing or the I. It is a character of factual propositions that they are true or false. To be true they must correspond to experience and this experience must be that of some experiencer; but more than this, it must correspond to the experience of that particular experiencer for whom we say "it is true." This third term, "for whom," may be implicit or expressed but must always be considered when we deal with truth or falsity; for, in this, we are concerned with the reference of mind to matter, concrete in things, facts and experience.

SOLUS IPSE. That "I am I" and "you are you" forever precludes my experience from becoming your experience. It is inherently impossible for you to know what purple is for me, though you may know what is purple for me. It is not immediately apparent to you that you do not know what purple is to you, because you do know what is purple to you and because it is you who know. But purple is essentially adjectival to that which is purple to him for whom it is purple. To attempt to predicate anything of "purple" requires the metabasis in which are implicit alternative modes

of analysis; but these are restricted to an analysis of fact.

#### THE SIGNIFICANCE OF THE LOGICAL STRUCTURE OF MIND.

"I am I"; "You are you." Each is a statement of fact which no alternative modes of analysis transcend. The metabasis cannot bridge the gap. But here the logical character of mind renders insignificant the breach. As far as the logical character of mind is concerned, purple is an idea and, as such, for logic is merely that particular identity signified by the word purple. We agree to say of the cow: "She is purple." How this has been achieved we have shown in the passage concerning the ambiguous state. The word "purple," like the sound "Kau," then represents symbolically, for you and for me the idea that was there for us then. To ask whether "your idea" is the same as "my idea" is to lose sight of the proper reference of mind to matter by failing to ask: "For whom?" Purple means to me just that idea which was there for me; to you, just that idea which was there for you. An idea is an entity of which it makes no sense to ask whether it is identical. Your mode of analysis of experience and my mode of analysis of experience, each yielded an entity of the eidetic type symbolized by purple and present in the cow. For logic that is all that is requisite. This relation between my thought and your thought, both symbolized by purple, is intentional — not one of identity.

IMAGINATION. The problem of image, or of imagination, is not the same as that of the idea. An image of a thing is, in a certain sense, a thing. It has its idea in common with the thing of which it is the image, but it exhibits passage and extension other than that of the thing of which it is the image. Only in a derivative sense is it appropriate to speak of it as intending the thing. It is eidetically related to that thing. It may be used to represent the thing, in which case it exhibits an intentional relation to the thing; but the intending itself is an activity of the intender. Only in one special case, in which the image is to be found as a thing spatio-temporally within the intender, does it resemble a thought.

THINKING. A thought is presumably a thing — presumably, rather than experimentally, because heads are not open for direct inspection of propositionalizing. Thought is not restricted, as image, to the eidetic relation to other things. It may be related to entities which are not things. It is related to other things, or other entities, intentionally. Thus thoughts

differ from other things in that they exhibit intention, effective in intending, as the characteristic passage from thought to thought. This intending occurs within the nervous system of the intender. But the characteristic relation of extension, namely whole and part, is replaced, for that intender, by an analysis yielding intentions; so that any entire entity of the type of thought, such as this thesis, yields subordination and superordination of intentions for its author — though obviously the subordinate and superordinate relations would be replaced for a neurologist, examining the neural process, by tempero-spatial parts. The intention of the entire thesis implies the intentions explicit in the parts. The idea of thought is intention itself. To be a thought is to be intentional.

**RESUME.** A thought is a thing which, for the thinker and all who receive it, exhibits all its aitia (causes) intentionally. We have shown how this arose by the metabasis eis allo genos, alternative modes of analysis, symbolism, the representational character of neural processes, through the ambiguous state. In so doing we have shown how it was possible for a thing — in this instance a purely neural affair within the organism — through the creative indicative gesture and response to it, to lose track of the affect, concentrate on the idea, recognize the intention and begin to think. To lose track of the affect, other than that to thinking, is prerequisite to theory, which is the idea of systematized thought. Of this practice is the obverse.

**LOGIC IN THEORY AND PRACTICE.** Thinking is a neural activity, manifest to us as propositions external to the proposer. To pass from one to the other there exists a characteristic activity called speaking. It is so closely related to thinking, eidetically and intentionally, that the distinction is sometimes lost; though the one is essentially theory and the other practice. Thinking necessarily proceeds in terms of entities which are given once-for-all. We have shown how words become more and more ideally restricted to symbolize these entities. The laws of thought and the laws of logic are not identical.

**CHARACTER AS EXAMPLE OF LOGICAL STRUCTURE OF MIND.** Logic is the law of thought in so far as it necessarily deals with entities created once-for-all and symbolized by words. But words are not necessarily spoken; they may be written; they may be nothing more than

indicative gestures. All those entities which convey to us the character of a man are fundamentally logical, however variously they may appear. Understood as related, they exhibit that man, in so far as he has any character, as a specific example necessarily exhibiting the logical structure of mind.

## EXTRADUCTION

THE BEGINNING OF THE END. Aristotle in describing a work of art says that it consists of three parts, the last of which he calls the end. Of it, he says, that it requires something before it but nothing after it. This is the beginning of the end. We hope that it will be impossible to understand it without the rest of the thesis, for it is supposed to be an organic whole containing no gratuitous parts. We have shown how the material and mental relations of things, in the metabasis by alternative modes of analysis, yielded the substantives, mind and matter. It was in the discussion of the organisms in the ambiguous state that we laid the conceptual foundations for "minding" and "mattering" as transitive factual verbs, symbolizing passage, limited neither to the organism as the ultimate unit composed of members, nor to the organism as the ultimate unit composing his universe. The problem cannot be stated in its full complexity without employing propositions equally complex. We have pointed out that this was possible at all only on account of the logical structure of mind. The usual procedure, in attempting descriptions of entities however complex, is the formation of propositions of the copulative two-term-type. They give a specious simplicity and suggest a clarity by concealing the complexity of the problem itself. Next, recourse is had to relations other than the copulative but of an essentially mathematical variety. Finally, propositional functions and system functions appear. This worked well in the physical sciences, except that the equations involved failed to represent the one-wayedness of the world which found subsidiary expression either as that "heat will not itself pass from a colder to a warmer body" or "die Entropie der Welt strebt einem Maximum zu," both of which are factual propositions. In the case of psychiatry, the logic of predication of relations, propositions and propositional functions, of systems and of system functions, meets the same fate as in physics; but at the beginning, instead of at the end, of its career.

PSYCHOSIS OF MINDING AND MATTERING DISTINGUISHED. In psychiatry it is not possible to dispense with either variety of proposition, predicative or factual, and among those which are essentially factual,

it remains to show that those of sentiment are frequently applicable and adequate, though in complex forms.

We have shown how intellectual critique arose in the specialization among affects to the organism in response to the indicative gesture so that the activity of intending became a specialized, recognizable activity. Psychoses present a differentiation, always present but complete only to the extent to which the segregation of the affect to intending has occurred in the given patient, between disturbances of intellect and disturbances of affect. The degrees of segregation and the degree of intention are not necessarily covariant.

**DEFECTIVE MINDING.** In general, intellectual defects, in so far as they present poverty of propositions characterized by paucity of ideas, deficiency of intentional sub- and super-ordination, and restriction of thoughts to images – "thing-mindedness" – can usually be described without recourse to propositions of fact or sentiment. But, even here, the attempt to understand these defects requires that they be proposed in the full concreteness of fact in order to exhibit how they came into being and how they exhibit their practical consequences.

**DEFECTIVE MATTERING.** When we consider the disorders of affect, we must necessarily resort to factual propositions. In these disorders the entire behavior of the patient, in so far as it can be understood in terms of the propositional significance of his actions, requires attention directed primarily to his factual relation to the world.

**FORMALISTIC MISTAKE.** The analysis of experience into facts, to which the alternative mode is apparently absent, yields the experience of the patient as his own and the experience of the psychiatrist as his own. We have shown how, on account of the logical structure of mind, the chasm between these facts can be bridged in the case of mental entities by the word as proposition arising from the indicative gesture. But it is possible to teach a parrot words that have lost their significance as words. The parrot reproduces the sound that he hears. The idea is that of the sound, not the idea of that to which the sound was intentionally related. So it happens that the mentally deficient, learning by rote, produces what seem propositions but are devoid of that propositional significance which the examiner attributes to them. Apart from this difficulty,

which is not insurmountable, it is possible to quantify and qualify intellectual defect, though as yet it is difficult to pursue the analysis further.

**PROBLEM OF VERACITY:** But the problem with respect to the affect is by no means easy. To record what was done to the patient and what he then did is factually inadequate. We need to know what was under way within him. His anticipatory reactions are not necessarily represented by overt behavior. For knowledge of them we are dependent upon indicative gestures which point at that which we cannot see. The problem of truth arises.

**STRENGTH OF ANTICIPATORY REACTIONS.** When we compare this problem with that in which the patient is exhibiting an emotion which is visible to us and to which what is then done to the patient is affective, it becomes at once apparent that we are dependent upon the veracity of the patient when there is no patent emotion, except in those cases in which what is done to the patient is sufficient to determine the response of the patient regardless of anticipatory reactions. Short of destruction no stimuli are universally so potent. Laevus got his name because he held his right hand in the fire to demonstrate the strength of his anticipatory reactions.

**SENTIMENT.** But Laevus did more than this. He demonstrated the importance of a sentiment which is a propositional function involving anticipatory reactions. The statement of an anticipatory reaction is a three-termed expression of the factual type. Hence the statement of affect, in its complete form, is a very complicated affair and always involves the problem of truth. For example, "I believe that he hated me and therefore expected me to hurt him; so, when I held out my hand, he bit it!" That we reason in such a manner, no one can deny. The word, "I believe," instead of "I know," implies the problem of veracity. There are always present mental entities, usually explicitly as well as implicitly represented in such propositions. But the relations are not copulative nor limited to intention. The analysis of the psychopathia waits the formal development of a logic of the verbs of fact and sentiment. Only so can we hope to cope with minding and mattering in order to develop a psychology and psychiatry restricted neither to sociology nor to physiology. Sentiments are the least analytical units which can be

said to exhibit psychic properties. In them minding and mattering are still concrete. Of them character is the logical structure without which man is mad.